Physical, Chemical and Zooplankton Data from the Canada Basin, August 2003

F. McLaughlin, A. Proshutinsky, E.C. Carmack, K. Shimada, M. Corkum, V. Forsland, C. Guay, C. Guéguen, B. van Hardenberg, R. Hopcroft, M. Itoh, R. Krishfield, L. Miller, J. Nelson, W. Richardson, D. Sieberg, J. Smith, M. Steel, N. Tanaka, L. White and S. Zimmermann

Fisheries and Oceans
Science Branch, Pacific Region
Institute of Ocean Sciences
9860 West Saanich Road
Sidney, B.C. V8L 4B2

2010

Canadian Data Report of Hydrography and Ocean Sciences 184

Fisheries and Oceans Canada   Pêches et Océans Canada

Canada

Canadian Data Report of Hydrography and Ocean Sciences

Data reports provide a medium for the documentation and dissemination of data in a form directly useable by the scientific and engineering communities. Generally, the reports will contain raw and/or analyzed data but will not contain interpretations of the data. Such compilations will commonly have been prepared in support of work related to the programs and interests of the Oceans and Science sectors of Fisheries and Oceans Canada.

The correct citation for data reports appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts.*

Data reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Regional and headquarters establishments of the former Ocean Science and Surveys sector ceased publication of their various report series in December 1981. A complete listing of these publications and the last number issued under each title are published in the *Canadian Journal of Fisheries and Aquatic Sciences*, Volume 38: Index to Publications 1981. The current series began with Report Number 1 in January 1982.

Rapport statistique canadien sur l'hydrographie et les sciences océaniques

Les rapports statistiques servent de véhicule pour la compilation et la diffusion des données sous une forme directement utilisable par les scientifiques et les ingénieurs. En général, les rapports contiennent des données brutes ou analysées mais ne fournissent pas d'interprétations des données. Ces compilations sont préparées le plus souvent à l'appui de travaux reliés aux programmes et intérêts des secteurs des Océans et des Sciences de Pêches et Océans Canada.

Le titre exact des rapports statistiques figure au-dessus du résumé de chaque rapport. Les rapports statistiques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports statistiques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page de titre.

Les établissements de l'ancien secteur des Sciences et Levés océaniques dans les régions et à l'administration centrale ont cessé de publier leurs diverses séries de rapports en décembre 1981. Vous trouverez dans l'index des publications du volume 38 du *Journal canadien des sciences halieutiques et aquatiques*, la liste de ces publications ainsi que le dernier numéro paru dans chaque catégorie. La nouvelle série a commencé avec la publication du rapport numéro 1 en janvier 1982.

Canadian Data Report of
Hydrography and Ocean Sciences 184

2010

PHYSICAL, CHEMICAL AND ZOOPLANKTON DATA FROM THE CANADA BASIN, AUGUST 2003

by

F. McLaughlin, A. Proshutinsky, E.C. Carmack, K. Shimada,
M. Corkum, V. Forsland, C. Guay, C. Guéguen, B. van Hardenberg, R. Hopcroft,
M. Itoh, R. Krishfield, L. Miller, J. Nelson, W. Richardson, D. Sieberg,
J. Smith, M. Steel, N. Tanaka, L. White, and S. Zimmermann

Fisheries and Oceans
Science Branch, Pacific Region
Institute of Ocean Sciences
9860 West Saanich Road
Sidney, B.C. V8L 4B2

Cat. No. Fs 97-16/184E ISSN 0711-6721

Correct citation for this publication:

McLaughlin, F., Proshutinsky, A., Carmack, E.C., Shimada, K., Corkum, M., Forsland, V., Guay, C., Guéguen, C., van Hardenberg, B., Hopcroft, R., Itoh, M., Krishfield, R., Miller, L., Nelson, J., Richardson, W., Sieberg, D., Smith, J., Steel, M., Tanaka, N., White, L., and Zimmermann, S. 2010. Physical, chemical and zooplankton data from the Canada Basin, August 2003. *Can. Data Rep. Hydrogr. Ocean. Sci. 184:* ix + 303 p.

Table of Contents

List of Tables

List of Figures

Abstract

McLaughlin, F., Proshutinsky, A., Carmack, E.C., Shimada, K., Corkum, M., Forsland, V., Guay, C., Guéguen, C., van Hardenberg, B., Hopcroft, R., Itoh, M., Krishfield, R., Miller, L., Nelson, J., Richardson, W., Sieberg, D., Smith, J., Steel, M., Tanaka, N., White, L., and Zimmermann, S. 2010. Physical, chemical and zooplankton data from the Canada Basin, August 2003. *Can. Data Rep. Hydrogr. Ocean. Sci. 184:* ix + 303 p.

A hydrographic survey of the Arctic Ocean's Canada Basin was conducted during a Joint Ocean Ice Study (JOIS) expedition aboard the *CCGS Louis S. St-Laurent* from 6 August to 7 September, 2003 (Institute of Ocean Sciences Mission Number 2003-21). The objective of the program was to investigate ocean circulation, Pacific and Atlantic-origin water mass distributions, storage of freshwater in the Beaufort Gyre, interannual variability and the distribution and concentration of zooplankton. This report provides a summary of all science activities conducted during the cruise and includes data collected from CTD/rosette casts. The CTD consists of pressure, temperature, salinity, dissolved oxygen, transmission and fluorescence sensor data and the rosette bottle data include salinity, dissolved oxygen, nutrients, oxygen isotope ratio, barium, dissolved inorganic carbon, alkalinity, chlorophyll-a and phaeopigment, iodine and cesium radionuclides, halocarbons including CFCs, total organic carbon and CDOM. Sample collection and analytical methods are described. Other samples collected during the expedition, not reported here, are also listed.

Résumé

McLaughlin, F., Proshutinsky, A., Carmack, E.C., Shimada, K., Corkum, M., Forsland, V., Guay, C., Guéguen, C., van Hardenberg, B., Hopcroft, R., Itoh, M., Krishfield, R., Miller, L., Nelson, J., Richardson, W., Sieberg, D., Smith, J., Steel, M., Tanaka, N., White, L., and Zimmermann, S. 2010. Physical, chemical and zooplankton data from the Canada Basin, August 2003. *Can. Data Rep. Hydrogr. Ocean Sci.* 184: ix + 303 p.

Une enquête hydrograhique de l'eau du bassin Canada, dans l'océan Arctique, ont été évaluées lors d'une expédition menée dans le cadre des Études conjointes sur les glaces (JOIS) à bord du NGCC *Louis S. St-Laurent*, du 6 août au 7 septembre 2003 (mission numéro 2003-21 de l'Institut des sciences de la mer). L'objet du programme était d'étudier les mouvements de circulation océaniques, notamment la distribution des masses d'eau d'origine atlantique et pacifique, les réserves d'eau douce de la gyre de Beaufort, les variabilités interannuelles et la distribution/concentration de zooplancton. Ce rapport présente un sommaire de toutes les activités scientifiques ainsi que les données des profils de conductivité-température-profondeur (CTP)/Rosette. Les données de CTP informent sur la pression, la température, la salinité et la teneur en oxygène, alors que les données captées par transmission et fluorescence et les données de bouteille (données recueillies dans des échantillons d'eau) touchent la salinité ainsi que la teneur en oxygène, en nutriments, le ratio des isotopes de l'oxygène, en baryum, en carbone inorganique dissous, l'alcalinité, en chlorophylle *a* et en phaéopigments, en radionucléides de l'iode et du césium, halocarbures, y compris les CFS, en carbone organique total et CDOM. Les méthodes d'échantillonnage et d'analyse sont décrites. D'autres échantillons prélevés au cours de l'expédition mais non traités dans ce rapport sont également mentionnés.

Acknowledgements

We would like to thank Captain Bryon Gibbons and the officers and crew of the *CCGS Louis S. St-Laurent* who made us feel welcome on board, and who generously helped us above and beyond the call of duty in our quest to make the most of this science mission. In addition we would like to thank the Canadian Ice Service for ice and weather information.

This work was supported by Fisheries and Oceans Canada in collaboration with scientists from the Japan Agency for Marine-Earth Science and Technology and Woods Hole Oceanographic Institution. A portion of the costs of the JWACS cruise and hydrographic station data, and the BGFE mooring and buoy installations was provided by NSF grant number OPP-0230184 as part of the Beaufort Gyre Freshwater Experiment (A. Proshutinsky, Principal Investigator). Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

1. INTRODUCTION

The Joint Ocean Ice Study (JOIS) is a collaboration between DFO researchers from the Institute of Ocean Sciences (IOS) and colleagues from Japan and the U.S. It combines two ongoing programs: the Joint Western Arctic Climate Study (JWACS), a collaboration with scientists from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) to conduct oceanographic surveys; and the Beaufort Gyre Exploration Project (BGEP), a collaboration with scientists from Woods Hole Oceanographic Institution (WHOI) in the U.S. to deploy and service moorings and buoys. The four primary investigators are Fiona McLaughlin (DFO), Eddy Carmack (DFO), Andrey Proshutinsky (WHOI) and Koji Shimada (JAMSTEC).

The JOIS-2003 study area extended across the Arctic Ocean's southern Canada Basin as far west as 170°W, and north to 80°N. The program objective was to study the effects of climate variability and the relationships between the physical environment and biota across shelf break, slope and basin domains. Specifically, the objectives were:

- To understand the impacts of global climate change on the physical environment by linking decadal scale perturbations in the Arctic atmosphere (e.g. Arctic Oscillation and Beaufort Gyre) to interannual basin-scale changes in water mass properties and circulation.
- To understand the impacts of global climate change on sea ice and other fresh water products by utilizing a suite of stable isotopes and geochemical markers to quantify freshwater into their meteoric and sea ice components.
- To investigate water mass modification due to processes such as convection and primary production with a suite of geochemical tracers.
- To understand the impacts of global climate change on the distribution of biota by investigating distributions and abundances of zooplankton.

The program was conducted aboard the *CCGS Louis S. St-Laurent* from 6 August to 7 September, 2003 (Institute of Ocean Sciences Mission Number 2003-21). A science team of 16 people (**Appendix 1**) conducted Conductivity, Temperature and Depth (CTD) rosette casts, mooring and buoy recovery and deployments, expendable CTD (XCTD) casts and vertical net tow operations. A high resolution, full ocean-depth hydrographic survey of the southern Canada Basin was obtained.

This report provides a summary of all science activities and data collected from CTD/rosette casts: the CTD data include pressure, temperature, salinity, oxygen, transmission and fluorescence sensor data; and the rosette bottle data include salinity, dissolved oxygen, nutrients including nitrate plus nitrite (hereafter referred to as nitrate), reactive silicate (hereafter referred to as silicate), orthophosphate (hereafter referred to as phosphate), oxygen isotope ratio ($\delta^{18}O$),

barium, dissolved inorganic carbon (DIC), alkalinity, chlorophyll-a and phaeopigment (total, 10 µm and 2 µm), iodine and cesium radionuclides (^{129}I and ^{137}Cs), halocarbons including CFC-11 and CFC-12 (hereafter referred to as CFCs), total organic carbon (TOC) and coloured dissolved organic matter (CDOM). Sample collection procedures and analytical methods for the CTD rosette water chemistry program, conducted primarily by the team from the IOS, are also reported. Other samples collected but not included in this report are hexachlorocyclohexane (HCH), Carbon-13 isotope (^{13}C), Helium/Tritium, Carbon-14 isotope (^{14}C), carbohydrates (CHO), dissolved organic carbon (DOC) and particulate organic carbon (POC).

1.1 FIELD WORK SUMMARY

The main science program was conducted in the Beaufort Sea and Canada Basin. Science was also conducted opportunistically in Davis Strait, Baffin Bay and the Canadian Arctic Archipelago during the transit of the ship from its home port in Dartmouth, NS to Kugluktuk, NU. Mission #2003-21 accomplishments are summarized below and data included in this report are listed in bold font. Specific location and time of events are listed in **Appendix 2**.

In the Canada Basin CTD/Rosette casts were conducted to obtain high quality profiles of water column properties, and water column samples from discrete depths were collected to depths over 3800 m deep. Plankton nets were used at the CTD/R locations to collect samples from vertical hauls to 100 metres. XCTD probes were deployed to obtain profile observations of temperature and salinity between these CTD/R stations. Since the ice in the central parts of the Canada Basin was unexpectedly weak, thin and broken, the ship made rapid progress with little effort. To take advantage of these favourable conditions, the hydrographic survey was extended to include sampling along an additional west-to-east section in the northern part of the Canada Basin and an extension of the section undertaken last year going into the deep Basin. The main pack of hard old ice was encountered on approach to the eastern side of the Canada Basin.

As part of JWACS, two stationary moorings, deployed in 2002 near the Northwind Ridge and Chukchi Slope, were recovered and redeployed and two new stationary moorings were deployed near Hanna Shoal on the Chukchi Shelf. One J-CAD drifting ice buoy was successfully recovered and one new J-CAD buoy was deployed. As part of BGFE, three stationary moorings and four drifting ice buoys were deployed in the deep central Canada Basin. Through a collaboration with the International Arctic Research Center (IARC), a mooring in the southeast Beaufort Sea was recovered and redeployed.

The JAMSTEC ROV was deployed to investigate the underside of sea ice and the ship's propellers.

Transit from Dartmouth, NS to Kugluktuk, NU:

- 31 XCTDs were deployed by Hirokatsu Uno along a section through Davis Strait and Baffin Bay. The ship left Dartmouth, NS on July 15, 2003.

Canada Basin Survey:
August 7 to September 7, 2003, Kugluktuk to Kugluktuk, NU

Total distance traveled by the ship was over 4200 nm.

Data summarized in this report are outlined in **bold font**:

- **47 CTD/Rosette casts at 39 stations**
  1. CTD: The primary CTD (a Seabird SBE911+) was equipped with dual **temperature** sensors, dual conductivity sensors (for **salinity**), SBE43 **oxygen** probe, **transmissometer**, **fluorometer**, bottom contact warning and an altimeter.
  2. Rosette: Water chemistry samples drawn from the 24 10 L Niskin bottles include **salinity, dissolved oxygen, nitrate, silicate, phosphate,** δ^{18}**O, barium, DIC, alkalinity, total chlorophyll-a** and **phaeopigment,** ^{137}**Cs** and ^{129}**I, CFCs, TOC** and **CDOM**. Other samples collected but not included in this report are HCH, ^{13}C, Helium/Tritium, ^{14}C, CHO, DOC and POC.

- 87 XCTD probes launched along track of ship.

- 8 new instrumented oceanographic moorings deployed and 3 recovered.

- 8 data-transmitting buoys placed on sea ice.

- One J-CAD drifting ice buoy recovered and one deployed.

- 46 vertical net tows at 24 stations to 100 m; samples were collected with nets having 53 µm, **150 µm** and **236 µm** mesh size.

1.2 STUDY AREA

The station locations and accompanying ice conditions are shown in Figures 1 through 4 below. Position information was collected from the ship's GPS. The GPS's NMEA string was fed directly into the cruise track software (Fugawi) and the CTD acquisition software (Seasave by Seabird Inc.). Specific station locations are listed in **Appendix 2**.

Figure 1. View of the Arctic showing the Canada Basin study area in the blue box.

The stations in the Canada Basin are shown in Figure 2. Stations were occupied in a clockwise fashion beginning in the south-east corner near Tuktoyoktuk. This cruise track allowed the ship to work in optimal ice conditions, i.e. to start in the southern ice-free area, move northward and then eastward when the ice was near the seasonal minimum. Ice conditions at the start and end of the cruise are shown in Figures 3 and 4.

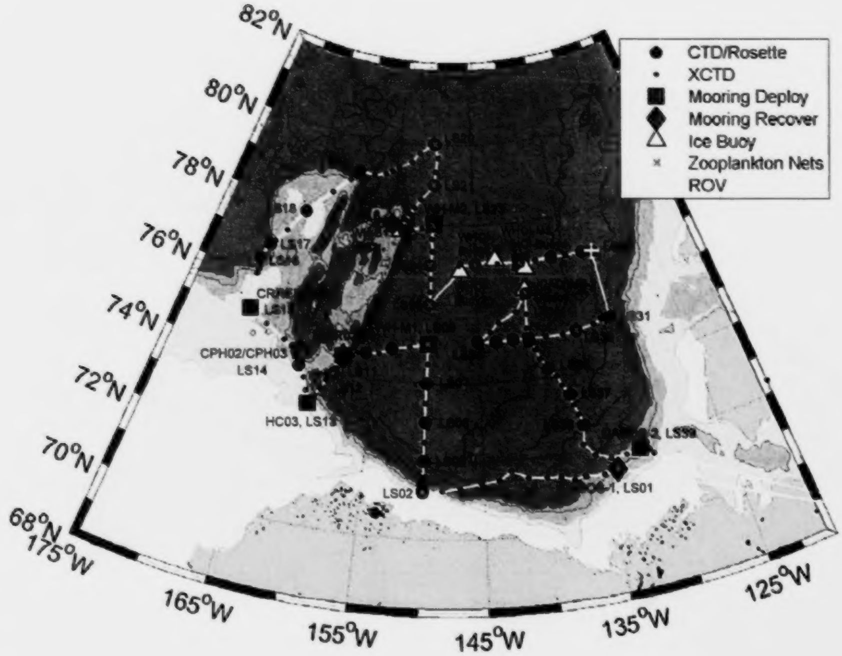


Figure 2. Cruise track and station locations in the Canada Basin.

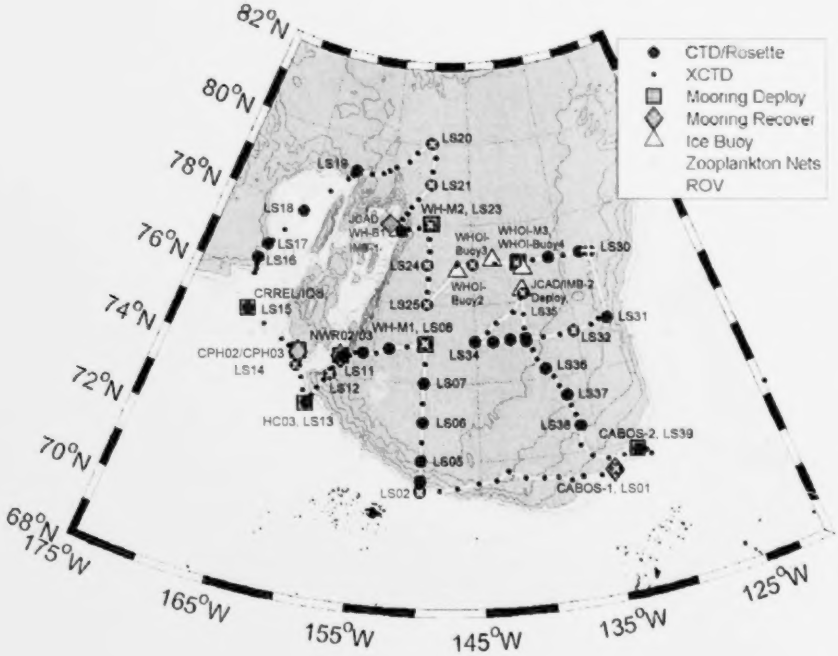


Figure 2. Cruise track and station locations in the Canada Basin.

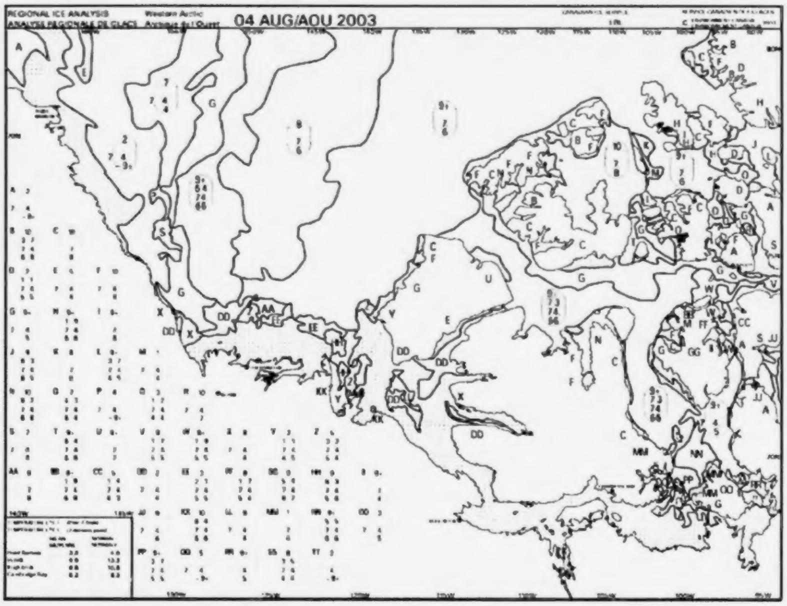


Figure 3. Regional ice analysis by the Canadian Ice Service on August 4, 2003, the start of the cruise.

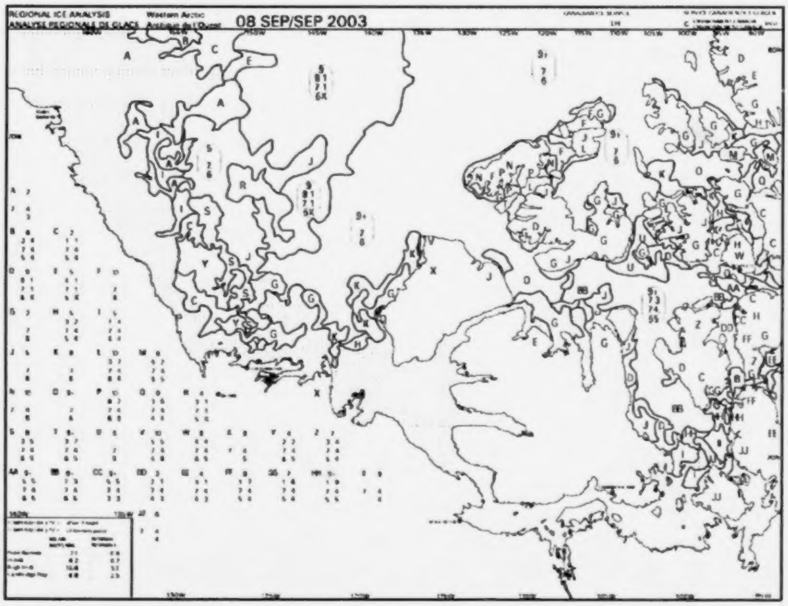


Figure 4. Regional ice analysis by the Canadian Ice Service on September 8, 2003, the end of the cruise.

2. METHODS AND ANALYSIS

2.1 SCIENCE PLATFORM: *CCGS Louis S. St-Laurent*

The *CCGS Louis S. St-Laurent* is a 26,000 HP Canadian Coast Guard icebreaker equipped with helicopter and deployable rigid hull boats. An ice specialist from the Canadian Ice Services, a member of the ship's compliment, received ice analysis images and weather information, made daily ice and weather observations and assisted in navigation and information regarding science station locations.

The Canada Basin was ice covered north of 72°N during August 2003 thus operations were dependent on the ship making openings in the ice to allow deployments and recoveries. Mooring and vertical net tow operations were performed from the ship's foredeck using the starboard crane and A-frame. The CTD/Rosette casts were performed on the boat deck, mid-ships, using a starboard A-frame. The XCTDs were deployed from the aft deck by a handheld launcher. Ice buoys were deployed away from the ship, using a portable gantry set up on the ice.

The ship's forward science lab was used as a mooring instrument shop, the rosette and CTD operations were performed from the boat deck container labs, nutrient, oxygen, chlorophyll analyses were performed in the main lab, salinity analysis was performed in the more temperature stable after-lab, and zooplankton operations were split between the well-ventilated container lab on the foredeck and the after-lab.

Ships soundings were taken using an ELAC 15 kHz depth sounder displayed on paper charts and a portable Ross 12 kHz depth sounder. No continuous measurements were recorded.

2.2 FIELD SAMPLING: CTD/ROSETTE CASTS

Rosette casts were taken with a Seabird SBE911plus CTD system, operating at a 24Hz scan rate, equipped with dual temperature sensors, dual conductivity sensors, SBE43 oxygen probe, Wetlabs CST–DR transmissometer, Seapoint pumped fluorometer, bottom contact warning device and Benthos altimeter. See **Appendix 3** for sensor serial numbers, calibration information and position on frame. Twenty-four 10 liter Niskin bottles with internal stainless steel springs made by Brooke Ocean Technology, also mounted on the frame, were used to collect water samples at most stations for salinity, dissolved oxygen, nutrients, $\delta^{18}O$, barium, chlorophyll-a and phaepigment, ^{13}C (surface only), CDOM, CHO, DOC and POC; samples for CFCs, ^{129}I, ^{137}Cs, DIC, Helium, Tritium, HCH and ^{14}C were collected at select stations only.

A typical full depth cast took 3.5 hours to complete. The ship stopped

near the pre-determined location to find a position that would keep the wire clear of ice during the deployment. If ice approached the wire during deployment the wire was moved closer to the ship for protection or the winch spooling stopped while the ice pushed by, preventing the wire from sawing into and getting caught in the ice. The ship's bubbler system was also used to push ice out of the way although the bubblers' location is most suited to clear the foredeck area, forward of the CTD/rosette launch area.

The CTD/rosette package was rolled out of the heated sampling container, the protective water-filled plugs removed from the temperature, conductivity and oxygen sensors, and the CTD turned on while on deck to record in-air information. The CTD/rosette was deployed after communication was established between the CTD, SBE 32 water sampler and computer, connected by 5500 m of single conductor CTD wire.

The rosette was lowered 1 m into the water, the sensor pumps turned on and the package soaked for 1 to 4 min to equilibrate the oxygen sensor. The package was then lowered to within 10 m of the ocean floor at 1 m/s. Bottles were closed on the upcast without slowing the raising speed (1 m/s) to capture the least disturbed water. Occasionally the CTD was stopped on the upcast (~4 times per cast), so wire adjustments could be made to the winch. Bottles were tripped at standard depths.

The CTD/rosette was rolled back into the heated rosette room, the water-filled sensor plugs reattached and the water sampler rinsed with fresh water. Care was taken to avoid rinsing the Niskin bottles prior to being sampled.

Water sampling took place immediately after each cast, CFCs, oxygen and DIC samples being collected first. Dissolved oxygen, nutrients, chlorophyll-a and phaeopigments, and a number of salinity samples were measured on board. All other samples were stored for subsequent analysis on shore.

2.2.1 Reported Data

2.2.1.1 Downcast CTD Files

The downcast CTD data are provided in 1-db averaged files with one file per cast. Standard Seabird processing steps were used. Pressure, primary temperature, secondary conductivity and oxygen were calibrated. Data from spikes in temperature and salinity were replaced with linearly interpolated data. Transmission, fluorescence and altimetry data were not calibrated.

2.2.1.2 Chemistry

All water sample chemical data are provided in a spreadsheet and include station name, location, time, and associated CTD data, and referenced to a unique sample number.

2.3 CTD DATA ACQUISITION, PROCESSING AND VALIDATION

2.3.1 Overview/Highlights

Refer to **Appendix 4** for CTD cast notes and list of cast number and depth where interpolation of CTD data was required.

- Primary conductivity sensor failed on casts 36, 37, and 38 due to cable problems, thus secondary conductivity was used for the final reported conductivity and CTD salinity.
- CTD winch had spooling problems requiring stops during the upcast to realign the wire. This should not impact the data.
- The oxygen sensor was found to have a tear in the membrane following the 2004 summer cruise. The tear could have occurred during the 2003 or 2004 mission. The tear resulted in oxygen values being noisier than usual.

See Table 1 below for details on CTD accuracy.

Table 1. CTD Accuracy for 2003-21.

Sensor	Accuracy (Standard Deviation)	Lab Calibration	Correction to Lab Calibration	Comment
Pressure	1.4 db	29 Oct 2002	None	Accuracy changed from 1db to 1.4db based on -0.4db surface bias.
Temperature	0.001°C	Pre cruise	None	Based on pre and post cruise lab calibration
Salinity	0.001 PSU below 300m	Pre cruise conductivity calibration	Adjusted offset by 0.00458	From water sample comparisons
Oxygen	0.05 mL/L	Pre cruise	Adjusted voffset, soc, and applied pressure dependant offset	From water sample comparisons and comparisons to other data sets.
Transmissivity	NA	None	None	No calibration
Fluorescence	NA, minimum detection level is 0.02 mg/m^3	None	None	No calibration
Altimeter	NA	None	None	No calibration

2.3.2 Acquisition and Processing Steps

CTD data were acquired and processed with Seabird software on a PC platform with further processing using Matlab-based routines performed by Motoyo Itoh, JAMSTEC and Sarah Zimmermann. Acquisition occurred real -time through a conducting cable from the CTD to a PC running *Seasave* (Seasave Win32 V 5.28c). The ship's GPS position was added to the header file via the NMEA interface. Upon completion of the station, the data were processed using Seabird's Windows-based processing software, *SBEDataProcessing*, to produce 1db averaged downcast and upcast profiles. The standard processing steps were: sensor alignment through advancing conductivity; spike removal; a correction for the thermal mass of the temperature sensors; filtering; removal of pressure reversals; calculation of oxygen; averaging to 1 db levels; calculation of other derived properties; and the file separation between downcast and upcast profiles.

Final processing was completed using Matlab to calibrate salinity and oxygen, determine bottle-trip time offsets due to closing bottles 'on-the-fly', and remove spikes in the data. The fluorometer, transmissometer and altimeter data are unprocessed.

2.3.3 CTD Pressure

The pre-cruise lab calibration was used to process the pressure data. The average surface bias at the start of the casts was -0.4 db (average of every 5^{th} cast) with a standard deviation of 0.08 db. This bias was not corrected for in the data.

Using the stated SBE9plus pressure accuracy which is 0.015% of full scale (1.0 m where 6800 m is full scale), combined with the -0.4 db offset gives a final pressure accuracy of 1.4 db.

2.3.4 CTD Temperature

Pre- to post-cruise calibrations show negligible sensor drift (Figure 5). Over the range of temperatures sampled, -2 to 3 °C, both sensor show a drift of less than 0.0003 °C. The data presented are calibrated with the pre-cruise laboratory calibration.

Stated SBE9plus Temperature Accuracy is 0.001 °C. Results suggest this is appropriate for this data set.

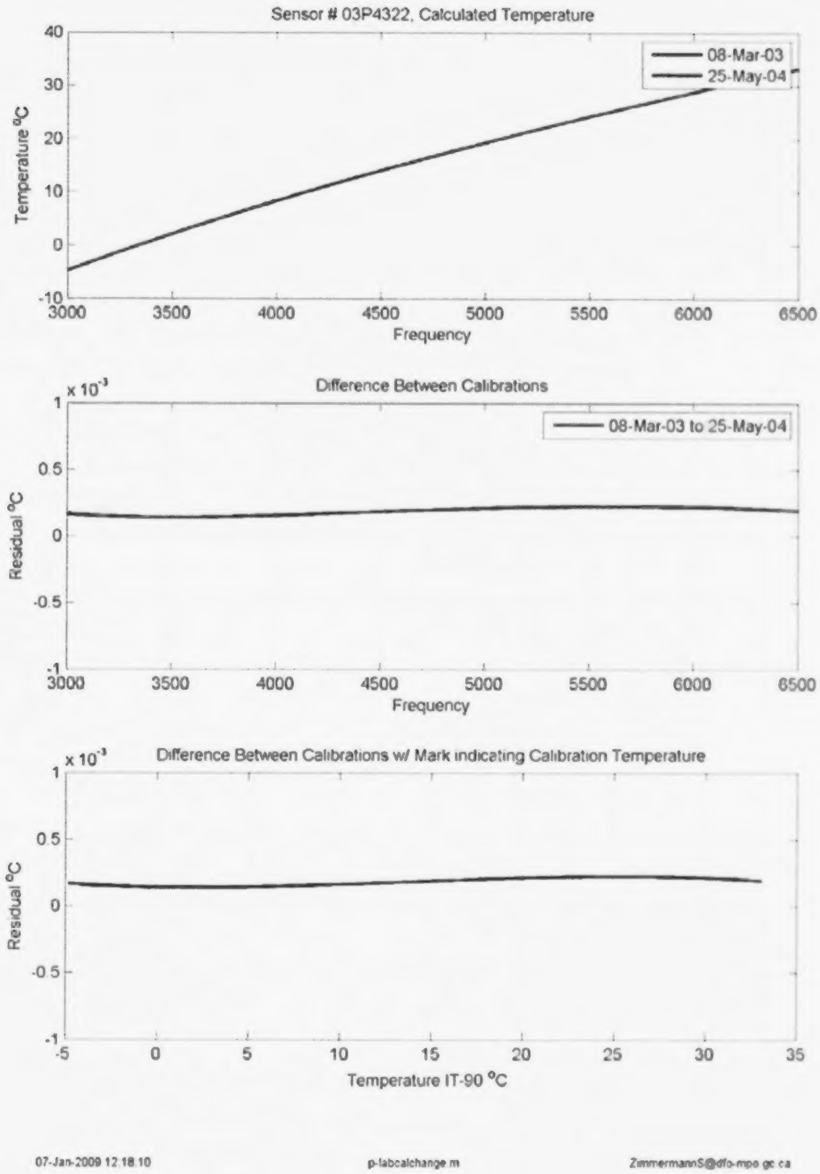


Figure 5. Laboratory calibration results, pre to post cruise, for primary temperature (SN4322).

2.3.5 CTD Conductivity and Salinity

Because the primary conductivity sensor, SN2809, failed for casts 36, 37 and 38 due to cable problems, data from the secondary conductivity sensor, SN2810, was used to produce the final salinity. CTD salinity was calibrated using water sample salinity. Water samples were found to be 0.00458 greater than CTD salinity, with a standard deviation of 0.00087. This was based on 58 out of 128 samples by excluding samples shallower than 300 m and with standard deviations outside of 2.0.

Calibrated CTD salinity = Raw CTD salinity + 0.00458

The laboratory calibration of conductivity shows a shift from pre to post cruise of 0.006 mS/cm supporting the correction found using the water samples (Figure 6).

Although not used, the primary sensor was also compared to water samples where water samples salinities were found to be 0.00592 greater than the CTD salinity with a standard deviation of 0.00096.

The applied correction brings the salinity of the deep Canada Basin very close to the measurements made in 2004 (34.9575 compared to 34.9573).

Stated SBE9plus conductivity accuracy is 0.003 mS/cm. Laboratory calibrations suggest this is appropriate for data shallower than 500 db. Calibration to bottle salts suggests an accuracy of 0.001 mS/cm is appropriate for the deeper water.

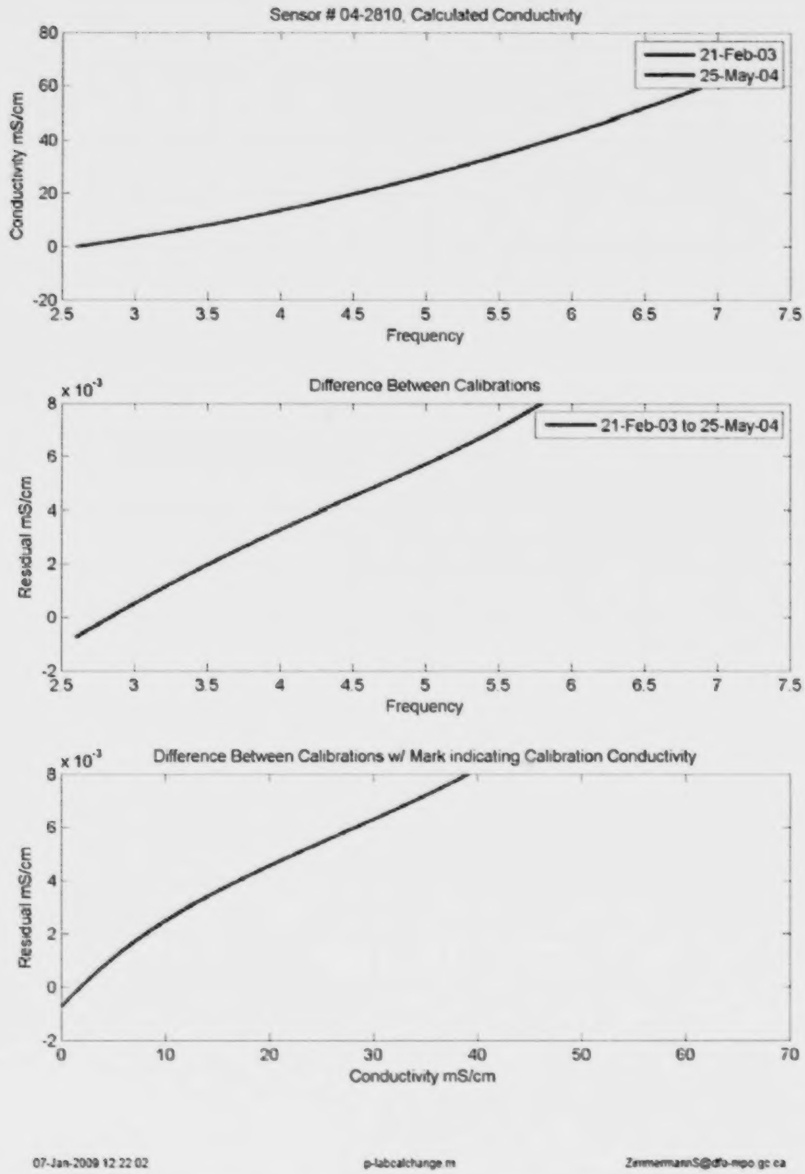


Figure 6. Laboratory calibration results, pre to post cruise, for secondary conductivity (SN2810).

2.3.6 CTD Oxygen

Performance

CTD oxygen standard deviation is ±0.05 mL/L based on the calibration results with the bottles, and looks appropriate based on comparisons with other data sets.

Dissolved oxygen water samples had a serious quality issue starting with cast 17 due a problem with the colorimeter. The quality of oxygen samples improved after switching to manual titrations beginning with cast 31. This required using other data sets to help in the processing of the CTD oxygen.

Calibration

The downcast oxygen data were calibrated to upcast oxygen water samples, with consideration given to the sensor lag, hysteresis and water sample quality. The downcast CTD oxygen was used instead of the upcast values due to the strong hysteresis of the CTD sensor (Seabird SBE43).

Coefficients were found following the Seabird method (Application Note 64-2: http://www.seabird.com/application_notes/AN64-2.htm). Two coefficients were determined (voffset and soc) per calibration group and were applied with the remaining four pre-cruise laboratory calibration coefficients to the lagged oxygen voltage (Table 2).

The oxygen voltage lag was determined to be between 6 and 8 seconds by comparing similar oxygen voltage features in the down and upcasts. The lag is partly due to the time water takes to physically move from the CTD intake to the sensor, and partly to the time response of the sensor. The 6 second lag was chosen over the 8 second lag because the down and upcasts matched better in the 250 to 400 db region. To apply the lag, the oxygen voltage was moved 6 seconds ahead of the other sensors.

At a given depth, the upcast oxygen voltage was consistently less than the downcast voltage. The deeper and longer the sensor was at depth, the larger the hysteresis. This variable hysteresis in the upcast was too difficult to correct so only the downcast was calibrated. The downcast CTD data were taken at bottle depths and compared to water samples. There was some error due to the real differences between down and upcast profiles which was minimized by using multiple casts for the calibrations. Taking CTD data from matching density instead of pressure in the upper 500 m was tested, however the STD was lower matching the CTD and water sample data on pressure.

The next lab calibration was performed after the following summer's cruise (2004) and revealed the sensor had a torn membrane. The tear may have occurred during this cruise or during the summer 2004 cruise. The effect of a torn membrane is noisier data.

Table 2. Coefficients for CTD oxygen equation using lag-corrected oxygen voltage.

Applied to Casts	Casts Used To Find Coeff	Boc	Tau	Tcor	Pcor	Voffset	Soc	STD	Lag (s)	# of Obs
1 to 37	1 to 16, 31 to 36	0	0	0.0015	1.35E-04	-0.4589	0.3709	0.053	6	273
38 to 47	38 to 47	0	0	0.0015	1.35E-04	-0.4502	0.3613	0.050	6	98

A further adjustment was made to the CTD data after making comparisons with following years data (2004 to 2008). 2003 values are less than the mean at depths greater than 500 db. The difference appeared pressure dependant, not oxygen concentration dependant. From this re-evaluation, the water samples' QA/QC were changed to fit the following years' data more closely and the CTD data were adjusted following Table 3 below. The CTD oxygen drifted progressively lower during the cruise with occasional jumps. Two correction profiles were found and applied to two groups (Casts 1 to 15 and Casts 16 to 47); see Figures 7 and 8.

Table 3. Correction to CTD oxygen (mL/L) for two groups. Corrections are less than 0.1 mL/L and only between 500 and 4000 db. Correction amount is linearly interpolated between depths in table.

Depth	Correction (mL/L) for Casts 1 to 15	Correction (mL/L) for Casts 16 to 47	
0	0	0	
500	0	0	
1000	0.02	0.02	
1500	0.04	0.04	
2500	0.04	0.08	
3950	0.06	0.095	
4000	0.06	0.095	

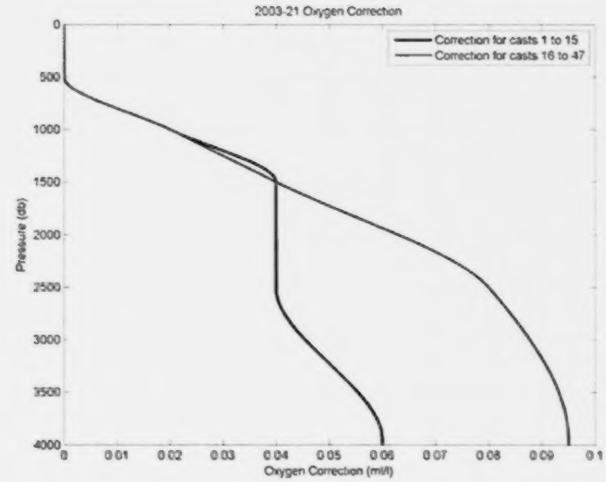


Figure 7. Correction profiles for CTD oxygen. The blue profile was added to casts 1 to 15. The red profile was added to casts 16 to 47.

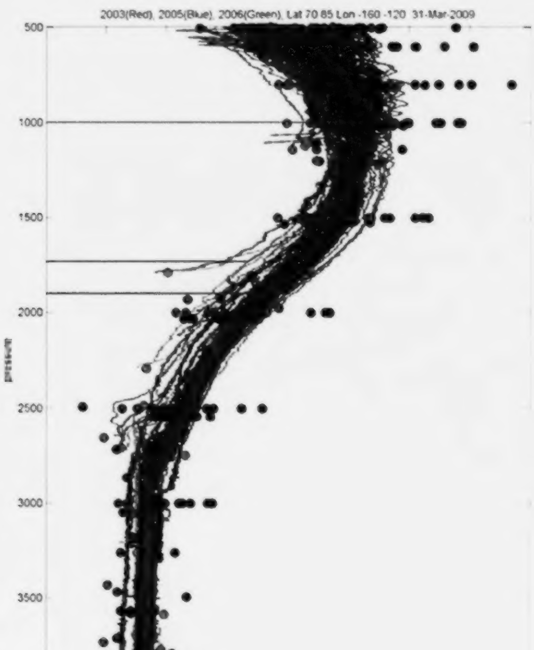


Figure 8. Final oxygen after correction is in red, compared with 2005 data in blue and 2006 data in green.

2.3.7 *CTD Transmission*

The transmissometer data were not calibrated.

2.3.8 *CTD Fluorescence*

The Seapoint fluorometer minimum detection level is 0.02 mg/m^3. The fluorometer was used with a 30x gain cable resulting in measurement range of 0 to 5 mg/m^3.

The fluorometer data were not calibrated, however chlorophyll-a data were collected (Figure 9). Water was pumped past the fluorometer, after the temperature and conductivity sensors, improving the consistency of the reading. The covered housing on the fluorometer prevented accessibility for cleaning during the cruise, which could result in a drift in the readings due to bio-fouling.

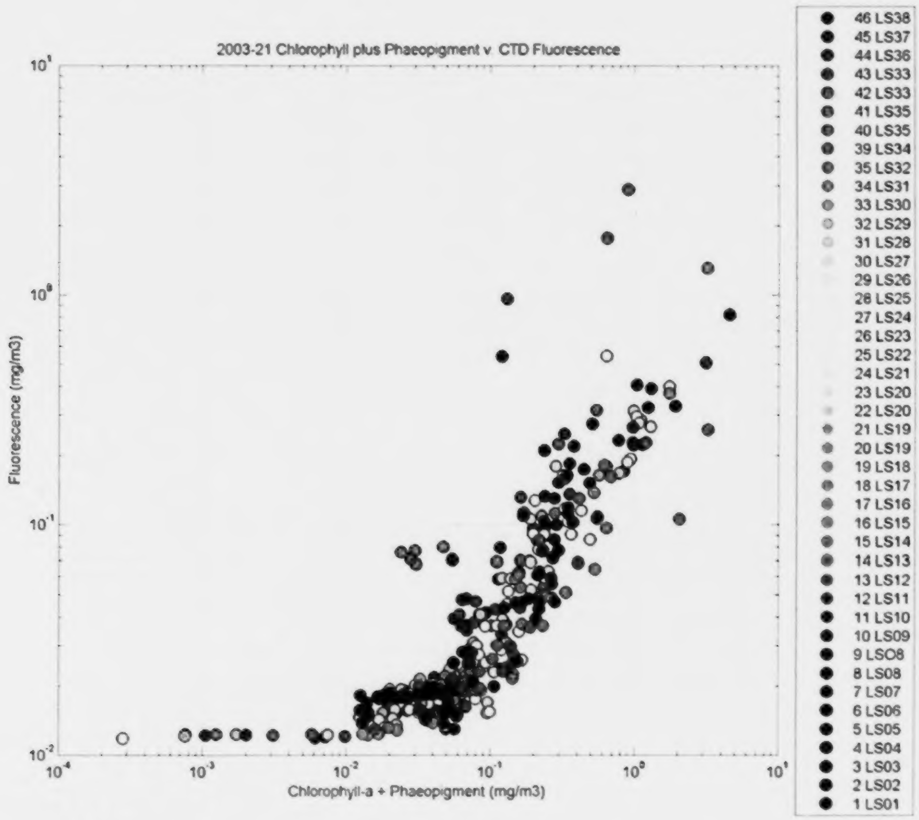


Figure 9. Plot of uncalibrated CTD fluorometer data against sampled chlorophyll-a plus phaeopigment.

2.3.9 Data Spike Removal

Data spikes in the 1db averaged downcast profiles were found using the density inversion criteria listed below. Linear interpolations were performed on both temperature and salinity if a spike was found in either property. Commonly the starting records were denser than the water below and in these cases the bad data were replaced with the first good value. Interpolations were all less than 10 db in duration except in two cases, casts 20 and 37, where they were 13 and 15 db respectively.

Criteria for temperature and salinity spike identification:
0 to 200 db, inversions over 0.004 $kg/m^3/m$
200 to 600 db, inversion over 0.001 $kg/m^3/m$
Over 600 db, inversions over 0.0005 $kg/m^3/m$

Cast number and depth where interpolation of CTD data was required are listed in **Appendix 4**.

2.3.10 CTD Data at Bottle Depths for Water Chemistry File

Niskin bottles were closed on-the-fly which due to bottle flushing affects results in an offset between the CTD recorded depth and the location the water in the Niskin actually came from. Salinity comparisons between water samples and CTD in the upper 300 m were used to determine which CTD data to match with the water samples.

The appropriate lag was found by comparing 0.2 second averaged CTD data (after applying conductivity calibration) to the bottle data. The comparisons were restricted to the upper 300 m where the vertical salinity gradient is large. Lags from -10 seconds to +10 seconds were tested. Casts show a 1.2 second shift (roughly 1db shallower) from the bottle trip location matches bottle salts the best (see Figure 10 and Table 4). There remains a bias of outliers in the upper 300 m of the water column where bottle salinity is larger than CTD. This bias is a result of tripping on the fly in high salinity gradient waters. It should be noted that the alternative, stopping the package for a bottle sample, also results in a bias due to the lack of ship-rock in ice covered waters that is needed to mechanically flush the bottles. Closing on-the-fly is thought to reduce the size of the bias, and produce a more repeatable response than stopping the package for bottle closures.

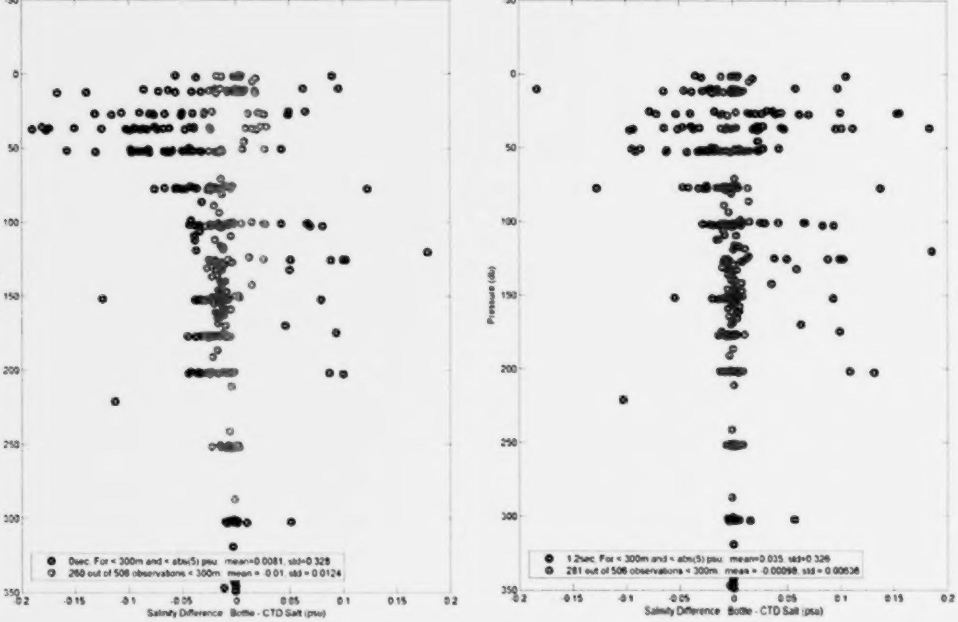


Figure 10. Water sample and CTD salt comparison using different time offsets on CTD data. a) No offset, CTD data directly from time of bottle closure. b) Offset of 1.2 second from bottle closure.

Table 4. **Bottle flushing test results showing offsets close to 1 second are the best based on a combination of number of good observations, the mean being close to 0 and a low standard deviation. Only test results between -1.2 and 1.8 seconds are shown in this table.**

	Blue values in plots			(Red values in plots)		
Seconds	Total Observations	Mean	STD	Good Observations	Mean	STD
1.80	506	0.047	0.328	266	0.0041	0.0064
1.60	506	0.043	0.327	257	0.0022	0.0054
1.40	506	0.039	0.326	284	0.0007	0.0066
1.20	506	0.035	0.326	281	-0.0010	0.0064
1.00	506	0.031	0.326	254	-0.0020	0.0052
0.80	506	0.027	0.326	232	-0.0037	0.0049
0.60	506	0.022	0.326	243	0.0220	0.3260
0.40	506	0.018	0.327	238	-0.0076	0.0079
0.20	506	0.013	0.327	227	-0.0085	0.0087
0.00	506	0.0081	0.328	260	-0.1000	0.0124
-0.20	506	0.0033	0.329	247	-0.0120	0.0123
-0.40	506	-0.0016	0.33	236	-0.0130	0.0128
-0.60	506	-0.0065	0.331	239	-0.0150	0.0142
-0.80	506	-0.012	0.332	227	-0.0150	0.0147
-1.00	506	-0.017	0.334	199	-0.0140	0.0141
-1.20	506	-0.022	0.336	226	-0.0180	0.0172

3. CHEMISTRY SAMPLING AND ANALYSIS

3.1.1 Overview/Highlights

Samples were collected for 24 water properties, listed below in Table 5.

Of Note:

- Although samples were drawn for CHO, DOC and POC (Laodong Guo; IARC), ^{14}C (IOS), ^{129}I (JAMSTEC) and HCH (IOS) analysis, they were not analyzed due to changes in plan and/or problems with equipment.
- Niskin bottles had a problem with leaking seals. Teflon tape was applied to the seals at the top and bottom of the bottles for every station to remedy this. All Niskin bottles on this rosette were replaced following this cruise.
- Oxygen precision was large at select stations due to failure of the colorimeter.
- Salinity samples were run primarily on shore due to problems keeping the ship's lab space at the necessary temperature control for the analysis.
- The 19 surface samples from 1 m depth were collected using either an over-the-side bucket or a submersible pump and hose lowered over the ships stern.

Nutrients, dissolved oxygen, total chlorophyll and chlorophyll size fraction (2 and 10 μm), and some of the salinities were analyzed on board. All other samples were brought back for analysis on shore.

All samples were referenced to a unique sample number associated to each Niskin closure.

See **Appendix 5** for single cast plots, **Appendix 6** for group property plots and **Appendix 7** for section plots.

Table 5. Water Sample Summary

Parameter	Canada Basin Casts (Casts 1 to 47)	Depths	Analyzed	Investigator	Comment
Salinity	All except 2,5,18,20,22,33,36-38,40,42,47	all	Ship and Shore Lab	Fiona McLaughlin (IOS)	In report
Dissolved Oxygen	All except 5,18,20,22,33,36-38,40,42,47	all	Ship	Fiona McLaughlin (IOS)	In report
Nutrients (Nitrate, Silicate, Phosphate)	All except 1,5,18,20,22,33,36-38,40,42,46,47	all	Ship	Fiona McLaughlin (IOS)	In report
$\delta^{18}O$	All except 1,5,9,18,20,22,25-38,40,42,47 [collected but unanalyzed 25-32, 34-35]	0 to 400 m typically	Shore Lab	Noriyuki Tanaka (IARC)	In report
Barium	All except 1,5,8,18,20,22,33,36-38,40,42,44,46-47	0 to 500 m, 1 deep typically	Shore Lab	Chris Guay (OSU)	In report
DIC/Alkalinity	2-4,6-8,10-17,19,21,23 24,39,41,43-46	0 to 400 m typically	Shore Lab	Fiona McLaughlin (IOS)	In report
Chlorophyll-a & Phaeopigment (Total using 0.7 µm filter)	2-4,6-17,19,21,23,-32,34,35,39,41,43-45	0 to 250 m, 1 deep	Ship	Fiona McLaughlin (IOS)	In report
Chlorophyll-a & Phaeopigment (2 µm & 10 µm filter)	2,3,6-17,23-28,34,43	0 to 250 m	Ship	Fiona McLaughlin (IOS)	In report
^{129}I	8,20-23,40,43 [collected but not analyzed 9, 24,30,42]	0 to 800 m	Shore Lab	John Smith (BIO)	In report
^{137}Cs	8,9,20,22,40,42	0 to 800 m	Shore Lab	John Smith (BIO)	In report
CFCs	21,23,24,40,41	0 to 3000 m	Shore Lab	Fiona McLaughlin (IOS)	In report
TOC	1,8,9,18,23,30,43	0 to 3000 m	Shore Lab	Fiona McLaughlin/Lisa Miller (IOS)	In report
CDOM	All except 5,18,23,33,36-38,46,47	0 to 600 m	Shore Lab	C. Gueguen (IARC/Trent*)	In report
^{13}C	2-4,7-11,13,14,16,17,19,23-25,28-30,32,34,35,39,41,43,45	Primarily surface (8 and 9 deep)	Shore Lab	C.S. Wong (IOS)	Not reported here
Helium/Tritium	8,23,29,30,32,34,35,39-41	0 to 3000 m	Shore Lab	Bob Newton (LDEO)	Not reported here
CHO	All except 5,18,23,33,36-38,46,47	0 to 600 m	Shore Lab	Laodong Guo (IARC)	Not analyzed
DOC	All except 5,18,23,33,36-38,46,47	0 to 600 m	Shore Lab	Laodong Guo (IARC)	Not analyzed
POC	All except 5,18,23,33,36-38,46,47	0 to 600 m	Shore Lab	Laodong Guo (IARC)	Not analyzed

The precision of the methods was estimated by analyzing replicates and is expressed as the pooled standard deviation, s_p, and calculated using the equation:

$$s_p = \sqrt{\frac{\sum[c(1) - c(2)]^2}{2n}}$$

where $c(1)$ and $c(2)$ are the concentrations of duplicate samples and n refers to the number of pairs. The precision of the reported data are summarized below in Table 6.

Table 6. Water Sample Precision

Chemistry Sample	Precision (s_p)	No. of Replicates in Calculation	Minimum Range	Maximum Range
Salinity	0.002 PSU	50	26.99 PSU	34.96 PSU
Dissolved Oxygen	0.040 mL/L	56	5.61 mL/L	9.74 mL/L
Nitrate	0.08 $mmol/m^3$	72	0.0 $mmol/m^3$	17.5 $mmol/m^3$
Silicate	0.15 $mmol/m^3$	73	1.46 $mmol/m^3$	40.26 $mmol/m^3$
Phosphate	0.01 $mmol/m^3$	69	0.53 $mmol/m^3$	2.20 $mmol/m^3$
Total Chlorophyll-a	~0.01 mg/m^3	1	0.000 mg/m^3	4.587 mg/m^3
Total Phaeopigment	~0.02 mg/m^3	1	0.000 mg/m^3	0.761 mg/m^3

Note: Samples were not collected in duplicate for $\delta^{18}O$, barium, DIC and alkalinity, ^{129}I, ^{137}Cs, CFC-11, CFC-12, TOC and CDOM.

3.1.1.1 Salinity

Samples were run primarily on-shore at IOS (758 of the 880 samples total) instead of at-sea due to problems keeping the ship's lab space temperature under control. However, it was determined the measurements made at sea were good and were used for the CTD calibration as the difference between the water sample groups (at-sea and on-shore) were less than the standard deviation of the calibration.

Sampling

Water samples were collected from Niskin bottles immediately following a rosette cast. For samples 1 through 714, salinity bottles were used with a two cap system, an insert cap followed by a screw on cap. Starting with sample 714, a different type of bottle was used that only had a one cap lid. Salinity bottles and insert caps were rinsed 3 times before filling.

Analysis at Sea

Samples were analyzed onboard on the Guildline Autosalinometer Model 8400A (SN: 49463) by Doug Sieberg. Procedures followed methods as outlined in the standard IOS protocol. Samples were transferred to the temperature controlled room for storage until they were analyzed within one week of collection. Autosalinometer tank temperature was kept at 24 °C, and room temperature was maintained between 21 and 23 °C as much as possible. Bottles were inverted and mixed prior to analysis.

IAPSO Standard Seawater (OSIL, batch P141, date 12June2002) was measured at the beginning and end of each run to calibrate the Autosal and identify instrumental drift. The value of OSIL, batch P141 is 34.997 PSU. Data are reported in practical salinity units (PSU) (Lewis & Perkin 1978).

Analysis on Shore

On shore, all but two samples were analyzed on the Guildline Portasalinometer #59724 by Bernard Minkley at IOS. The first two samples were analysed on Portasalinometer #58879, however the salinometer was unstable and further testing found voltage levels out of range and a damaged power supply circuit.

Procedure followed methods as outlined in the standard IOS protocol. IAPSO Standard Seawater (OSIL, batch P141) was run before and after the analysis. The first day the Portosal had a calibration drift requiring a correction to salinity values of 0.0045. All other days the instrument drift and associated correction was less than 0.002.

Precision

The samples run at-sea were from stations taken mid-way through the cruise and are within ±0.0006 of those run at IOS. This was determined by the 26 samples that were taken in duplicate; one analyzed at IOS and one at-sea. Measurements made at-sea are 0.00045 higher than those made at IOS. However, using the CTD as a reference (assumes CTD calibration did not change), the values from samples analyzed on board are 0.00056 lower than those analyzed at IOS. Using both comparisons, the salinity difference between the at-sea and on-shore samples is ±0.0006.

Duplicate samples run on shore at IOS have an s_p = 0.002 PSU with n = 50.

For the salinity of samples collected at depths greater than 3000 db (homogenous bottom water), the standard deviation is 0.0013 PSU with n = 26 and the average is 34.956 PSU.

3.1.1.2 Dissolved Oxygen

Sampling

Following the cast, once the Niskin bottle integrity was checked, samples were drawn first for CFCs (if CFCs were taken) and then dissolved oxygen. Water was drawn through rubber tubing into a calibrated (volume) glass flask with attached stopper. The stopper was inserted, excess water removed, the stopper removed and immediately pickled with 1.0 mL of manganous chloride then 1.0 mL alkaline iodide. The stopper was inserted, flask checked that no air bubbles were present and then the flask shaken to mix the contents. The flask was stored in the refrigerator until analysis.

Analysis

Dissolved oxygen samples were analyzed on board by Mary Steel within 24 hours of collection using an automated version of the Micro-Winkler Technique as described in Carpenter (1965). The methodology follows standard IOS protocol described by Minkley and Chase (1997). All chemical solutions were prepared at IOS. The titration was performed with a Metrohn Dosimat 665 and the end point was detected using a Brinkmann probe colorimeter PC910 SN 910-358. Software written at IOS (NewAutoOxy.exe) was used to calculate dissolved oxygen (mL/L).

Serious analytical problems began with cast 17 (LS-16). Bottle concentrations were 0.5 mL/L higher than expected with this cast. Casts 18 to 24 were approximately 0.2 mL/L too high. Casts 25 to 30 were between 0.1 to 0.2 mL/L too high. Thus, the profile shape is good, but there is a positive offset. The problem is thought to be due to a fault in the colorimeter. After the cruise, the colorimeter's failure was verified and the instrument was sent out for

servicing. Manual titrations were begun with Cast 31 (LS-28) resulting in immediate improvement in expected values. The CTD oxygen sensor, used as a reference, supports the manual titration values. The manual titrations were carried out using a bright light shining through the sample to a white board. No starch indicator was used.

Standards and Accuracy

Standards and blanks were measured whenever a new bottle of reagent and/or sodium thiosulfate or potassium iodate was opened. Subsequent analyses used these new values to calculate oxygen concentration.

The pooled standard deviation was s_p = 0.040 mL/L, n = 56 pairs from samples analyzed by both methods (colorimeter and visual titration).

Comparisons with CTD oxygen identified a large number of outliers and occasional groups of 2 to 3 stations with a positive offset. Outliers were flagged (following IOS quality assurance protocols) as questionable values (*c*) if the difference with the calibrated CTD oxygen was greater than 0.1 mL/L and flagged as bad values (*d*) and removed from the final data set if the difference was greater than 0.2 mL/L.

3.1.1.3 Nutrients

Sampling

Water samples for nutrient determination were collected into glass and polystyrene test tubes after the tube and cap had been rinsed three times with the sample water. If analysis could be performed within 24 hours the samples were stored at 4 °C, if not they were frozen at -20 °C.

Analysis and Results

Nutrients (nitrate, silicate and phosphate) were analyzed by Linda White onboard ship using a three channel Technicon Auto Analyzer, following the methods described by Barwell-Clarke and Whitney (1996). Reagents were prepared onboard using water from a NANOpure system that produced 17 to 18 mega ohm-cm resistance Type I reagent grade water. The system was supplied with ship's distilled water. A 3.2% weight-to-volume solution of sodium chloride (Sigma) was prepared daily and used to rinse the system between samples and to prepare working standards. Pump tubing was changed after approximately 500 samples. One cadmium column was used for all samples unless noted below. The Auto Analyzer was cleaned every other day as follows; rinsed with 3N NaOH and 10% HCl, sequentially, for approximately 5 minutes and rinsed with DMQ for over 20 minutes after all reagents and salt were disconnected at the end of the day. Data were logged by chart recorder and digitally using the IOS "Newget" program.

The nitrate colorimeter exhibited a serious drift problem and was replaced with the backup colorimeter on August 17, 2003 at Station LS14. The phosphate colorimeter exhibited a faulty response so the phosphate nutrient chemistry was run through the silicate channel starting on August 25, 2003; Station #LS23. The appropriate filter and phototube were exchanged. The phosphate transit lines were connected directly to the inlet of the silicate colorimeter. The interference filters and phototubes were installed for phosphate. Samples were not frozen. Nitrate and silicate were analyzed one day and phosphate the next. Samples were stored overnight in the refrigerator. There were no adverse effects to running the phosphate chemistry through the silicate colorimeter.

Standards and blanks

NANOpure water was analyzed daily before connecting the reagents and analyzing the initial standards and after the last set of standards to establish the baseline and record the purity of the reagents. A set of working standards (low, medium and high) were prepared from the stock standard solution, using freshly prepared 3.2% sodium chloride (Anachemia) solution. The stock solutions were prepared from: Potassium nitrate (Fisher); Sodium silicofluoride (Fisher); and Dihydrogen potassium phosphate (BDH Aristar). The working standards were analyzed at the start and close of each day or, if more than 60 samples were analyzed in a day, standards were also run mid-day or after three hours. Concentrations of the standards were selected to bracket the expected nutrient levels in the samples. A medium standard for each nutrient was analyzed between stations (consisting of 12 to 27) samples and as an unknown sample followed by two zero standards.

A Wako 20 mmol/m^3 nitrate standard and 50 mmol/m^3 silicate standard along with a shipboard seawater reference sample were analyzed daily to provide a check on the day-to-day calibration standard. An onboard seawater reference sample was collected at station LS08 at depth 3,000 m, August 14, 2003, and stored at 4 °C in the dark.

The order of the sample analysis was from the surface to depth and sample peaks that appeared to be out of order were re-analyzed. Duplicate samples were collected approximately every 10 samples. The results of the replicate and standards comparisons are listed below in Table 7.

The turbidity of surface samples where salinity was less than 27 PSU was determined through the phosphate channel with no reagents being added to the sample and no corrections were applied. When the nitrate level in surface samples was the same or slightly lower than the 3.2% sodium chloride solution it was reported as zero.

Table 7. Quality control and assurance for nutrient samples.

Nutrient	Nitrate + Nitrite	Silicate	Phosphate
Sample Replicates			
s_p	0.08 mmol/m^3	0.15 mmol/m^3	0.01 mmol/m^3
No. of duplicates	72	73	69
Medium check standard			
Calibrated value	20.1 mmol/m^3	39.9 mmol/m^3	2.02 mmol/m^3
Average and std dev	20.1 ± 0.05	40.6 ± 0.3	2.03 ± 0.02
No. of duplicates	10	17	18
LS08 # 178 onboard reference	14.2 ± 0.2 mmol/m^3	11.2 ± 0.1 mmol/m^3	1.04 ± 0.02 mmol/m^3
No. of replicates	10	11	8
Wako 20 μM (Nitrate), Wako 50 μM (Silicate)	20.0 ± 0.3	49.8 ± 0.5	
No. of duplicates	7	8	

3.1.1.4 Halocarbons: CFC-11, CFC-12

Seawater samples were ampouled by Wendy Richardson and Val Forsland and analyzed for CFCs back at IOS by John Harris. Due to contamination, CFC-113 and CCl_4 data are not reported.

Sampling

Halocarbon samples were the first to be drawn from the Niskin following the Niskin bottle integrity checks. The sample was collected in a Perfektum 250 mL glass syringe (Popper & Sons Inc.). Syringes were rinsed three times with ~ 30 mL of sample water and filled to 100 mL, taking care not to allow air bubbles enter the syringe. Syringes were capped and submerged in a bucket or sink filled with cold seawater to prevent contamination from the high CFC concentration in air.

The seawater samples were ampouled using a custom made ampouler with a stream selector valve (MPSS; Figure 11). UHP Nitrogen (at 40 psi) was used to flush the system and transfer the sample via the MPSS, where it was metered at 10 mL/min to the ampoule port (FP Cross). An ampoule was inserted into the ampoule port and the sample syringe inserted into the syringe port. The ampoule was rinsed with UHP Nitrogen for 5 minutes by turning the MPSS to position 2. The syringe port was set to drain and ~5 mL of sample was pushed through to clean the syringe port, then the MPSS valve set to position 3 and ~10 mL of sample was pushed into the ampoule. The valve was then set to position 4 with the syringe port closed and Drain 1 clamped shut. In this configuration the seawater sample was drained to waste using the Nitrogen pressure. These steps were repeated three times, and then the ampoule was filled with ~20 mL of the seawater sample. To seal the ampoule, the valve was

set to position 1 and the ampoule port lowered so the fill tube was at the top of the ampoule. A propane torch was used to melt the ampoule neck closed.

Analysis

The samples were analyzed back at IOS by John Harris using the custom-built ampouler sampler and a custom purge and trap extraction unit coupled to a GC-ECD; (Figures 12 through 14). The ampoule sampler was plumbed into the CFC System between the Valve 5 exit port and the water trap. The ampoule was etched with a file around the neck ~2 cm from the top. The neck was then rinsed with methanol and wiped with a Kimwipe. The ampoule was then inserted into the ampoule sampler and allowed to rinse under nitrogen flow for 15 minutes. The ampoule water sample GC and CFC program was started. At the appropriate time (to start purging), the stem cracker was pushed, breaking the ampoule neck where it was etched. The purge tube was then lowered to the bottom of the ampoule and the sample was purged with nitrogen. Stripped CFCs were then trapped and analyzed as usual.

After the sample had been purged, the ampoule (containing the seawater sample) was weighed, the ampoule emptied, dried then weighed again. The difference in weight was the weight of the water sample. The volume of sample was calculated using the weight and density of the sample as determined by its salinity.

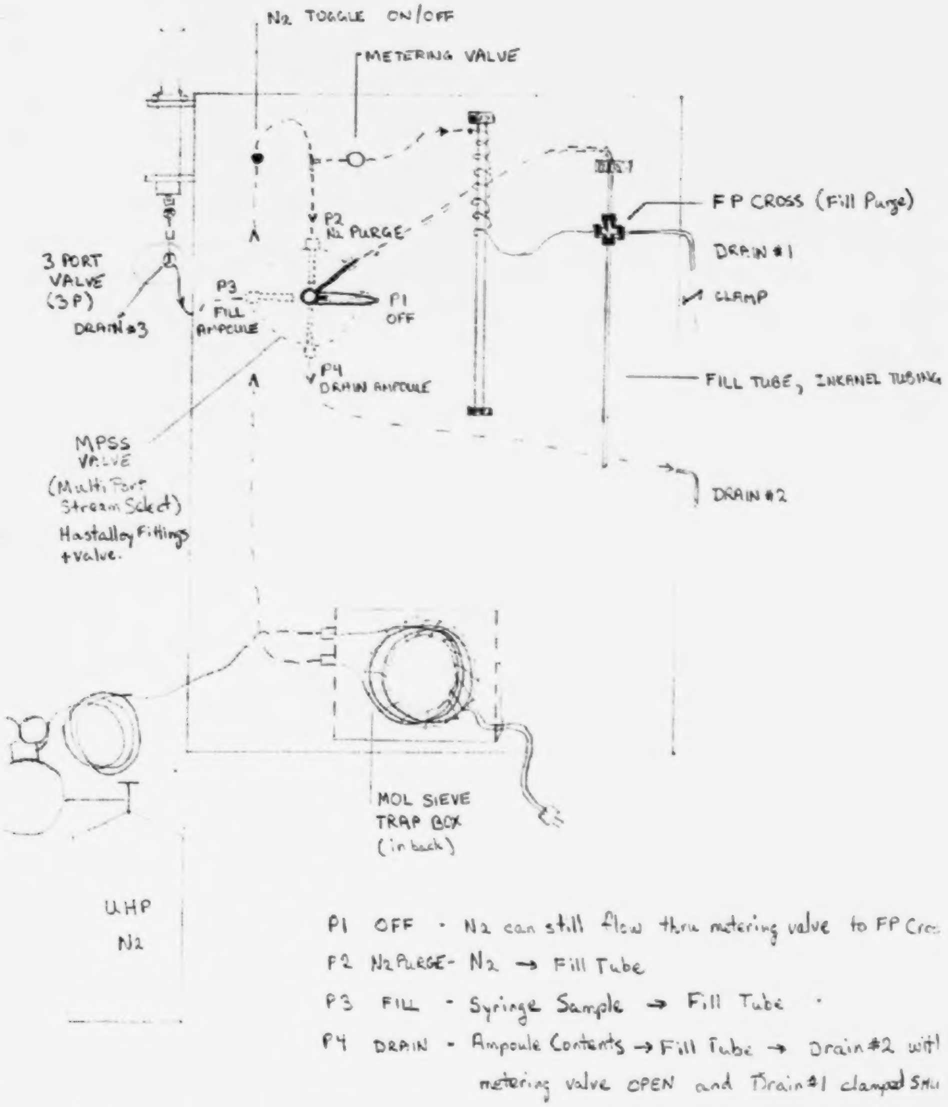


Figure 11. CFC Ampouler Diagram.

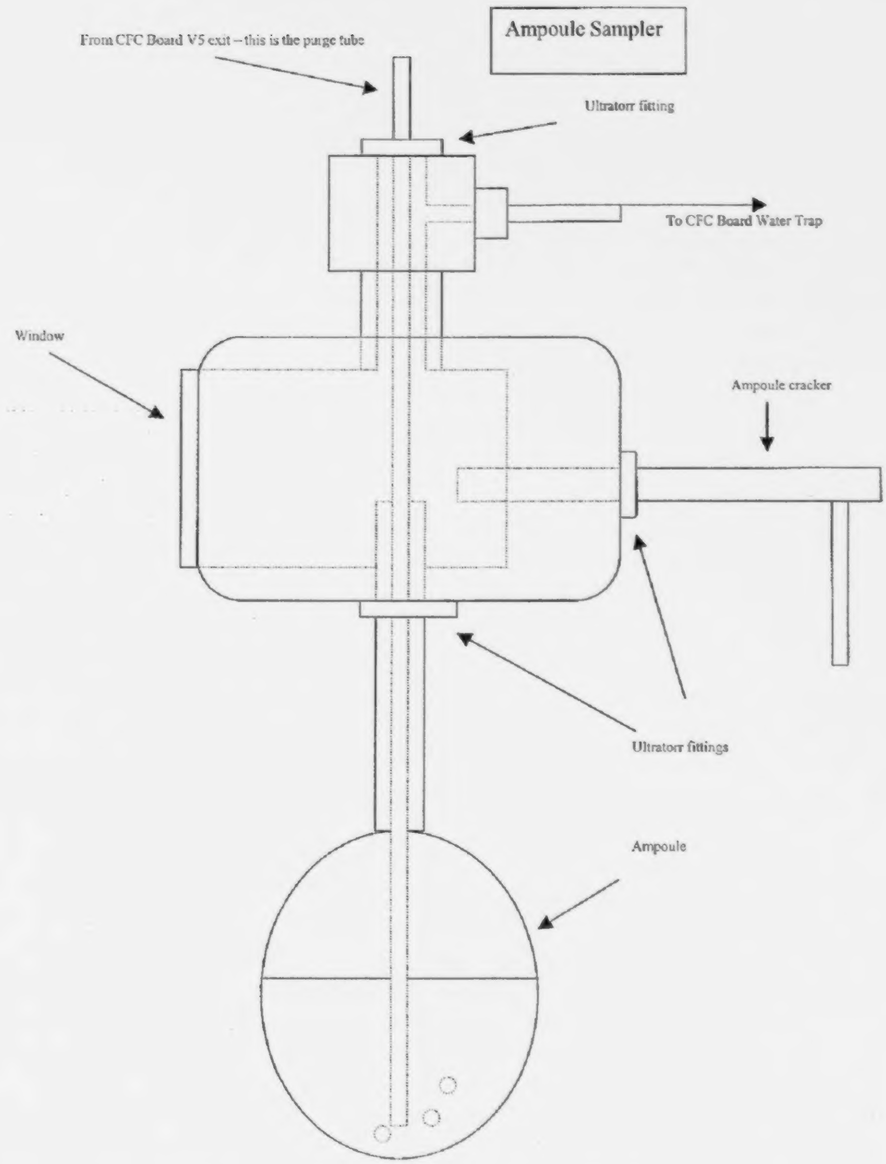


Figure 12. CFC Ampoule Sampler Schematic 1.

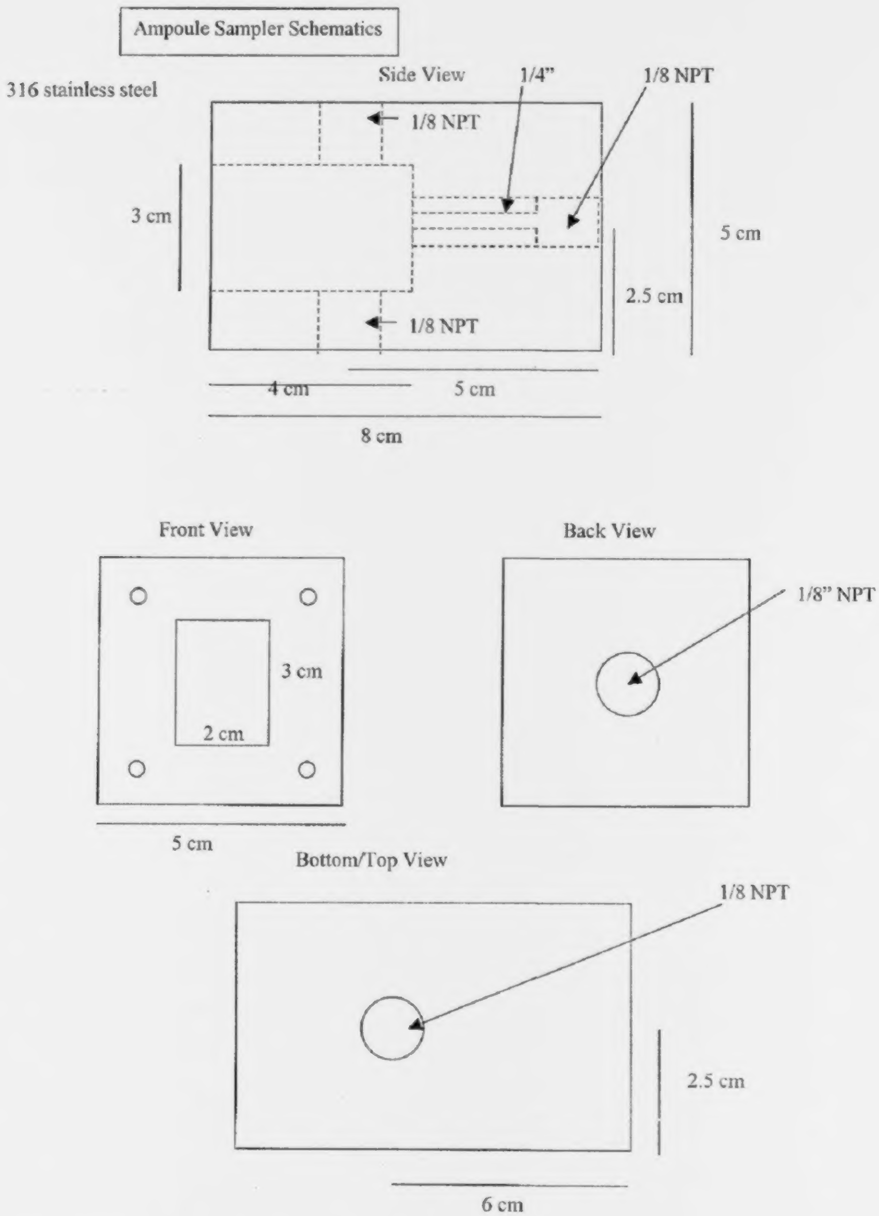


Figure 13. CFC Ampoule Sampler Schematic 2.

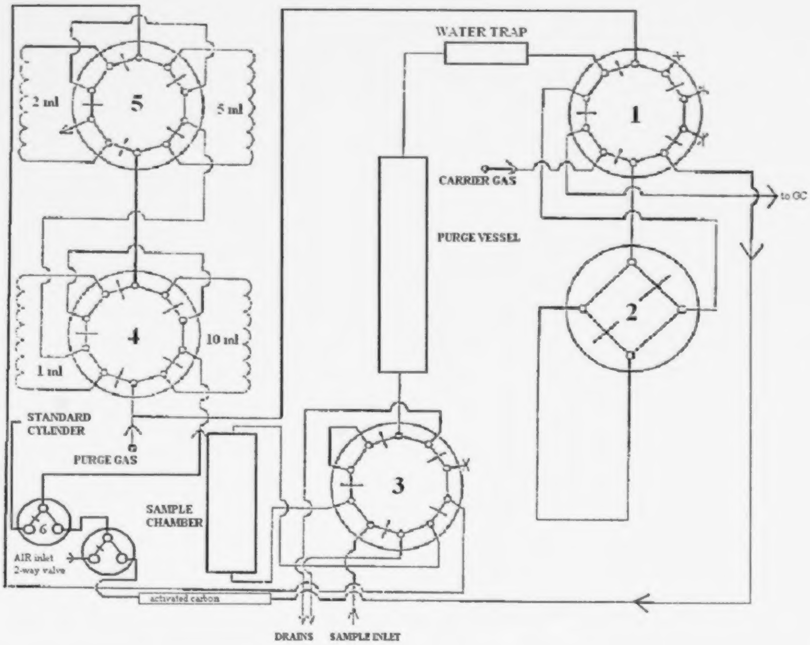


Figure 14. Freon System Diagram.

3.1.1.5 Oxygen Isotope Ratio

Sampling

In addition to samples taken from the rosette, samples were also taken from the sea-surface, typically at XCTD stations, using a pump or a bucket. All samples were transferred from into smaller glass vials, after rinsing vials and caps three times with sample water. Samples were kept at room temperature until analysis back on shore.

Analysis

Samples were analyzed at the International Arctic Research Center, University of Alaska Fairbanks, by Gordon Bower using a Finigan MAT 252 mass spectrometer connected to a H_2O-CO_2 equilibration unit. The oxygen isotope composition is referenced to Vienna-Standard Mean Ocean Water (V-SMOW): $\delta^{18}O = ((H_2{}^{18}O/H_2{}^{16}O)_{sample} / (H_2{}^{18}O/H_2{}^{16}O)_{VSMOW} - 1) \times 10^3$ [‰]. The obtained "raw" $\delta^{18}O$ values are normalized using internal laboratory standards, which was calibrated periodically using international standards (VSMOW, SLAP, GISP).

Internal standards used were Equatorial Pacific seawater ($\delta^{18}O$ = 0.38 ‰) and Fairbanks snow 2002 ($\delta^{18}O$ = -26.00 ‰). Precision of analysis calculated based on repeated internal standard analysis was < 0.05 ‰ (mean 0.03 ‰).

3.1.1.6 Barium

Barium samples were drawn from the Niskin into small plastic vials following three rinses of the vials. Once at room temperature the caps were retightened. Barium concentrations were determined at Oregon State University by Christopher Guay in 2005 on a VG Thermo Excel inductively coupled quadrupole mass spectrometer. An isotope dilution method was used as described in Falkner et al. (1994) with minor modifications. Briefly, 250 µL aliquots of sample were spiked with an equal volume of a ^{135}Ba-enriched solution (Oak Ridge National Laboratories) and diluted with 10 mL of 1% HNO_3. The spectrometer was operated in peak jump mode, and data were accumulated over three 20 s intervals for masses 135 and 138. Based on replicate analyses of samples and standardized reference materials, the precision (2-sigma) of the analytical procedure ranges from < 5% at 10 nmol/L to < 3% at 100 nmol/L. No duplicate samples were taken.

3.1.1.7 Dissolved Inorganic Carbon

Sampling

Seawater was transferred to a glass sample bottle (250 or 500 mL) as soon as possible after the rosette cast to minimize gas exchange. The sampling tube was connected to the spigot of the Niskin bottle and, by holding the tube above the spigot, was rinsed by flowing approximately one tube volume of sea water through the tube. Any trapped air bubbles were removed by tapping or squeezing the tube. The bottle was filled smoothly from the bottom (tubing touching the bottom of the bottle) and the bottle overflowed by two times its volume. The tubing was withdrawn to the neck and the spigot valve closed or the flow in the tubing squeezed off before the tubing was removed from the bottle. One percent of the stoppered sample volume was removed to leave a headspace (about 1% of the bottle volume -- i.e., 5 mL for a 500 mL bottle) by inserting a nylon plug into the bottle. A volume of 100 µL of saturated mercuric chloride solution ($HgCl_2$) was added to the bottle (both 250 mL or 500 mL). A greased stopper was inserted and sealed with elastic bands or electrical tape. Samples were stored at 4 °C until analysis back on shore. DIC and subsequently alkalinity were measured from the same sample.

Analysis

Samples were analyzed at IOS by Marty Davelaar using a SOMMA (Single-Operator Multi-Metabolic Analyzer) - Coulometer system to determine the concentration of DIC (also called total carbon dioxide). The SOMMA is a sea-going, computer-controlled automated dynamic headspace analysis, constructed at IOS by Ken Johnson (University of Rhode Island) and Keith Johnson (IOS). The current design of the SOMMA system is similar to the one described by

Johnson et al. (1993). The SOMMA is interfaced with an IBM compatible computer and a coulometric detector (UIC Coulometrics, model 5011). The SOMMA dispenses and acidifies a known volume of seawater, strips the resultant CO_2 from solution, dries it and delivers it to the coulometric detector.

At the start of each day, seawater was run through the system to condition the cell. Once the system appeared to be working well, standard water or a known sample was run to confirm proper operation. For each analysis (standard or sample) CO_2 in nitrogen was used to push liquid out of the sample bottle and into the water-jacketed calibrated pipette. The water from the pipette was then drained into a scrubber compartment to which approximately 0.5 mL of 8.5% o-phosphoric acid had been added. The CO_2 was stripped from the water by the acid and then passed into the coulometer cell where it was measured. The coulometer was operated in the µg C mode. Using the SOMMA software, this mode takes the coulometer's voltage to frequency converter output along with constants supplied by the user and calculates µmol *C* titrated. For each sample or standard, the analysis was run twice. The first analysis was considered a rinse and the second analysis the final value. The final concentrations are calibrated with the daily measured standard where:

$$\textit{corrected value} = \frac{\textit{(raw value * measured standard)}}{\textit{(standard value * correction for mercuric chloride volume)}}$$

The mercuric chloride correction is either 1.0002 or 1.0004, depending on whether the sample volume was 250 or 500 mL. DIC values are reported in µmol/kg, and the mercuric chloride correction was applied.

Standards, blanks and precision

The accuracy of DIC analysis was assured by daily analysis of IOS standard sea water (batch 11, concentration 2177.5 µmol/kg) which had been calibrated using certified reference material (batch 48 with a concentration of 1991.91 µmol/kg) (DOE 1994; Dickson 2001; Dickson et al. 2003) supplied by Andrew Dickson (Scripps Institute of Oceanography, San Diego, USA). The difference between the measured value and calibrated value of the IOS standard seawater was less than ± 1 (0.05%).

3.1.1.8 Alkalinity (paired with DIC)

Sampling

Alkalinity was measured from the same sample collected for DIC. Please see DIC section above for the sampling method.

Analysis

Samples were analyzed at IOS by Marty Davelaar using an automated potentiometric titration system to determine the total alkalinity. The pH was measured using a Ross combination electrode. Acid was dispensed with a Dosimat 665. A program written by the University of Hawaii was used to control the Dosimat.

At the start of each day, seawater was run through the system to condition the instruments. Once the system appeared to be working well, standard water was run to confirm proper operation. For each analysis (samples and standard), a known amount (~75 g) of sample was weighed in an open beaker. An initial amount of 0.7N (0.6N NaCl, 0.1N HCl) acid (IOS batch 3, concentration 0.09676), was added to the seawater to take its pH to approximately 3.5. Before 2004 a constant volume of initial acid was added regardless of the sample salinity meaning the initial pH may have been approx 3.2 instead of 3.5 for very fresh samples. After an eight minute period in which CO_2 was stripped from the seawater, 0.025 mL aliquots of acid were added to the seawater until a final pH of approximately 3.0 was obtained. The University of Hawaii program was used to calculate the alkalinity of the seawater by use of a Gran plot. The final concentrations are calibrated with the daily measured standard where:

$$\textit{corrected value} = \frac{\textit{(raw value * measured standard)}}{\textit{(standard value * correction for mercuric chloride volume)}}$$

The mercuric chloride correction is either 1.0002 or 1.0004, depending on whether the sample volume was 250 or 500 mL. Alkalinity values are reported in units of µmol/kg.

Standards and precision

The accuracy of the alkalinity analysis was assured by daily analysis of certified reference material (batch 57, concentration of 2230.33 ± 0.66 µmol/kg) (DOE 1994; Dickson 2001; Dickson et al. 2003) supplied by Andrew Dickson (Scripps Institute of Oceanography, San Diego, USA).

3.1.1.9 Chlorophyll-a and Phaeopigment

Chlorophyll a and phaeopigment methods follow the general procedure reported by Strickland and Parsons (1972) and by Arar and Collins (1997). Samples were analyzed onboard by Wendy Richardson.

Sampling and Filtration

Prior to the cruise, 500 mL brown Nalgene sample bottles were acid cleaned with 10% hydrochloric acid, rinsed twice with de-ionized water, then rinsed with double de-ionized water, air dried and capped. To collect a seawater sample the bottles were rinsed twice, filled to the brim or a calibration mark and capped. Each bottle had been calibrated with the exact volume to the nearest milliliter written on the outside of the bottle. Chlorophyll samples were drawn typically from 250 m to the surface. Total (>0.7 µm) Chlorophyll was sampled at 32 stations and Chlorophyll fractions (2 µm and 10 µm) at a subset of these.

The samples were kept cool and in the dark until they were filtered under 5 psi vacuum. Around 400 samples were drawn for Total Chlorophyll *a* (>0.7 µm) analysis and these were filtered on GF/F 25 mm filters (ADM manufacturing brand, Borosilicate Microfiber Filters) up to station LS33. For stations LS36 to LS37, Whatman GF/F 25 mm filters were used with a new filter blank applied to calculations. Another 200 samples for each size fraction were also analyzed. The 2 µm fraction was filtered on AMD Brand, Poretics, Polycarbonate, 47 mm filters in a polysulfone filter housing. The 10 µm fraction was filtered on AMD Brand, Poretics, Polycarbonate, 47 mm filters in a glass filter housing. The full sample was filtered as soon as possible after collection and the volume of sample filtered was recorded. The area around the filtration setup was maintained under very low lighting and the actual filtration apparatus was covered with dark plastic. The sides of the castle were not rinsed (in case the cells lysed and contents passed into the filtrate). Housings were rinsed with Nanopur water when all filtrations from a station were finished. Filters were placed in clean scintillation vials and either frozen at -20 °C for a few weeks until they were analyzed onboard ship or they were extracted immediately. Filter blanks consisted of a filter being placed directly into a scintillation vial and treated as a sample.

Extraction

A volume (10 mL) of 90% acetone/10% Nanopur water (double de-ionized) was added to scintillation vials, the vials were shaken vigorously and placed in a tray along with two filter blanks. The filter was submerged in the acetone solution, in the dark, and extracted for 24 hours in a -20 °C freezer.

Measurement

Fluorescence was measured using a Turner 10 AU Field Fluorometer SN 5152 FRXX. A solid standard was measured at the beginning and end of each day of analysis to validate the instrument operation. Samples were removed from the freezer in small batches to equilibrate for 1 hour in the dark and in the same lab as the fluorometer. The sample extracts were transferred to clean borosilicate test tubes without disturbing the filter paper. The tube exterior was wiped clean and placed in the Turner 10 AU Field Fluorometer sample holder making sure the sample cover was in place. Once the reading stabilized the chlorophyll-a fluorescence (Rb) was recorded. The extract was then acidified by the addition of 2 drops of 1N HCl and the phaeopigment fluorescence (R_a) was recorded. If the fluorescence was over range the samples were diluted with 90% acetone and re-read, with the dilution factor being recorded. Filter blanks were measured in the same manner as the samples.

Clean borosilicate test tubes were used for each sample eliminating possible sample to sample contamination of acid. Borosilicate tubes were cleaned with 10% solution of Extran, rinsed thoroughly with hot water with a final rinse of double de ionized water, air dried and re-used. Chlorophyll-a and phaeopigment values were corrected for filter blanks. The blanks were treated in exactly the same way as samples and the average filter blank was subtracted from each sample as an equivalent weight (µg) of chlorophyll-a or phaeo-pigment per filter.

To provide data for calibrating the CTD fluorometer, four samples were drawn in duplicate from Niskin #20 at Station LS37 (Sample #975) and were filtered on GF/F 25 mm Whatman filters volumes of 0, 0.5, 1.0 and 1.5 L. One set was analyzed on board and the other set analyzed at IOS.

Analysis and data reduction were completed on board by Wendy Richardson.

Standardization

The Turner Designs 10 AU – 005 Field Fluorometer SN 5152 FRXX was calibrated with 1 mg Chlorophyll a (Sigma C6144) extracted from *Anacystis nidulans* algae 4 June, 2003 by Linda White. Calibration solutions ranged from 0 to 20 µg/L. The slope and F_o/F_a were determined for the full range.

The stock solution from which dilutions were made was prepared by Melanie Quenneville, March 2003. The calibration solutions agreed with the March readings in June 2003. The fluorometer was not calibrated again until 9 June, 2004.

Filter blanks:

Whatman GF/F 0.7 µm 25 mm
0.000 µg/L Chl a, n = 2
0.001 µg/L Pheophytin, n = 2

AMD polycarbonate 2 µm 47 mm
0.000 µg/L Chl a, n = 1
0.000 µg/L Pheophytin, n = 1

AMD polycarbonate 10 µm 47 mm
0.000 µg/L Chl a, n = 1
0.001 µg/L Pheophytin, n = 1

No duplicate samples were taken except for sample #975 where four replicates were measured using different volumes of seawater (two of 500 mL, one of 1000 mL, one of 1500 mL) and the results are shown in Table 8. The standard deviation is similar to the Standard Pool results from the following two years where the same equipment and methods were used:

IOS Cruise #2004-16	s_p = 0.008 µg/L Chla, n = 208
	s_p = 0.013 µg/L Pheo-pigment, n = 208
IOS Cruise #2005-04	s_p = 0.007 µg/L Chla, n = 28
	s_p = 0.015 µg/L Pheo-pigment, n = 27

Table 8. Total Chlorophyll replicates taken from sample number 975.

On Board	Chl a (µg/L)	Phaeo (µg/L)	Samples
Mean	0.15	0.14	4
STD	0.004	0.013	4

*Note: sample volumes were 2 at 500 mL, one at 1000 mL and one at 1500 mL.

For a comparison between analysis on board and back on shore at IOS, a second set of replicates from the same sample #975 were filtered on board and brought back frozen for measurement at IOS. The volumes of the three samples were 500, 1000 and 1500 mL. The mean Chlorophyll value measured at IOS differed by 10 STDs from the value on board, likely due to a physical change in the samples due to extended freezing (Table 9).

Table 9. Chlorophyll comparison with analysis at IOS.

IOS	Chl a (µg/L)	Phaeo (µg/L)	Samples
Mean	0.11	0.13	3
STD	0.004	0.008	3

*Note: total Chlorophyll replicates from the same sample #975 measured at IOS (shore lab) after the cruise. Sample volumes were 500, 1000 and 1500 mL.

Precision estimate is based on the one replicate taken this cruise and data from two cruises (IOS cruise #2004-16 and 2005-04) that used the same equipment and methodology. Chlorophyll-a is 0.01 µg/L and Phaeopigment is 0.02 µg/L.

<u>Chlorophyll data processing</u>

Chlorophyll estimates and phaeopigment estimates are calculated following the procedure in JGOFS manual (1994). The basic equations used are as follows:

$$\text{Chl } (\mu g\ L^{-1}) = (F_m/F_m\text{-}1) \times (F_o\text{-}F_a) \times K_x \times (Vol_{ex}/Vol_{filt})$$

$$\text{Phaeo (chl equiv. wts)} = (F_m/F_m\text{-}1) \times [(F_m{*}F_a)\text{-}F_o] \times K_x \times (Vol_{ex}/Vol_{filt})$$

Where:

F_m = acidification coefficient (F_o/F_a) for pure chl (usually ~2)
F_o = reading before acidification
F_a = reading after acidification
K_x = door factor from calibration calculations (use 1.0)
Vol_{ex} = extraction volume (usually 10 mL acetone)
Vol_{filt} = sample volume

3.1.1.10 Radionuclides (Iodine 129 and Cesium 137)

Sampling and Analysis

Seawater samples for ^{129}I analyses were collected into 1 L PVC bottles that had been pre-rinsed with seawater to remove any foreign debris. Samples were returned to John Smith at the laboratory of the Atlantic Environmental Radioactivity Unit (AERU) at the Bedford Institute of Oceanography (BIO). In the laboratory, a NaI carrier was added to a 200 mL aliquot of the seawater sample, it was slightly acidified, purified using multiple hexane extractions and iodine was precipitated as NaI. The NaI precipitate was shipped to the IsoTrace Laboratory at the University of Toronto where ^{129}I analyses were performed by accelerator mass spectrometry (Smith et al. 1998; 1999; 2005).

The sample data were normalized to the IsoTrace Reference Material #2 ($^{129}I/^{127}I = [1.313 \pm 0.017] \times 10^{-11}$ atom ratio) which is calibrated using the NIST 3230 I and II standard reference material. The blank (KI carrier added to distilled and deionized water) for this procedure is $0.75 \pm 0.10 \times 10^{7}$ at/L and the standard deviation (one sigma) ranged from 5 to10% (Edmonds et al. 1998). ^{129}I concentrations in seawater are generally expressed in units of 10^{7} atoms/litre. IsoTrace has participated in a number of ^{129}I International intercomparison exercises, including the NIST SRM 4359 Seaweed, the Lawrence Livermore ^{129}I intercomparison, phases I and II and the IAEA-0375 Radionuclides in Soil intercomparison. IsoTrace ^{129}I procedures and sample handling protocol have been approved by the United States Office of Civilian Radioactive Waste Management, through on-site inspections by Bechtel SAIC Inc.

Approximately 20 to 30 L of seawater were collected into 10 L plastic carboys for ^{137}Cs analyses. The water samples were passed through a potassium ferrocyanide (KCFC) packed resin column in the laboratory which quantitatively extracts ^{137}Cs from seawater (Smith et al. 1990; Smith & Ellis 1995). A second column was occasionally aligned in series to confirm that extraction efficiencies for ^{137}Cs were close to 100%. The KCFC resin was deployed in a standard geometry and measured using a hyperpure Ge detector having an efficiency of 25%. ^{137}Cs concentrations in seawater are expressed either as Bq/m^3 or mBq/L. Numerous analytical intercomparisons (including publicly reported blind exercises) have been carried out with other laboratories by the (AERU) over the past 30 years for quality assurance purposes. Intercomparison samples have been provided by the United States Environmental Protection Agency (USEPA), the United States Environmental Measurements Laboratory (EML) and the United States Department of Energy as part of their Mixed Analyte Performance Evaluation Program, MAPEP. Marine environmental samples (e.g. IAEA-315; IAEA-326; IAEA-327) provided by the IAEA (International Atomic Energy Agency) have been analyzed to insure compliance with international standards in the marine radioactivity community. NIST (National Institute of Standards and Technology) ocean and river sediment reference materials are analyzed on the detectors on a regular basis as a calibration check.

See **Appendix 5.1** for ^{129}I and ^{137}Cs data plots.

3.1.1.11 Total Organic Carbon

Sampling

TOC samples were collected into pre-cleaned and rinsed glass vials with Teflon/silicone septa liners, then frozen at -70 °C or -20 °C until analysis in the lab facilities at IOS.

Samples were analyzed by Nes Sutherland at IOS by High Temperature Catalytic Oxidation, using a Tekmar Dohrman Apollo 9000HS (High Sensitivity) analyser with an NDIR (Nondispersive Infrared) detector, and STS 8000 Autosampler. Instrument parameters were set to 680 to 700 °C furnace temperature, using Pt over TiO_2 catalyst, 4 minute sparge of ~10 mL sample treated with 200 µL of 21% H_3PO_4. Actual sample injection size was 200 µL. The samples were analysed in five separate data sets, each data set lasting 3 to 5 days.

Standards of potassium biphthalate solution (Tekmar Dohrman 1000 µg/mL stock) were prepared directly into the TOC vials, for calibration runs performed at the beginning, middle and end of sample sets. Recirculated Milli-Q (RmQ) was used for Low Carbon blanks and drift calculations. Daily Reference Standards (DRS), prepared from bulk water collected either from deep water in the north Pacific or the Arctic Ocean, were also used to monitor drift and response changes. In addition, Certified Reference Material (CRM), obtained from Hansell Labs in Florida were analysed daily. Typically, an analysis set would start with warm-up blanks and seawater samples until the system was stable, then standards would be run, blanks compared with the Hansell Low Carbon water, followed by samples. Samples would be run in a series of 1 to 2 blanks, followed by a DRS, then 5 samples (each with 5 injections), and so forth. Bermuda Sea Water CRMs were inserted daily, following a DRS.

Determining blanks is notoriously difficult in DOC analysis. The Apollo system has a program that cleans the RmQ through the column, and then reinjects it to provide a system blank; however, this is best done at the start of an analysis run, as the injection of larger quantities of RmQ appears to wash more accumulating salts from the top of the column into the catalyst, creating problems. RmQ blanks are compared with the system blanks, and if very different, the system is further cleaned, and the RmQ recirculated for a longer period of time before retesting. For one analysis set, the RmQ blanks did not clear up, and instead the Low C CRM was used as a blank correction. The frequent use of RmQ blanks allows for continual monitoring and subsequent correction of drift and seawater carryover that can occur when very high organic samples are introduced. These blanks have been found to be approximately the same as the blank that would be predicted by using the calibration slope and expected CRM DOC content.

For each sample, all peaks were manually scanned for baseline or peak irregularities, and only the area of acceptable peaks was averaged. To calculate sample concentration, blank values were subtracted, then the calibration curve

regression applied. Replication within an individual vial resulted in an overall average of RSD = 4.2%. Replication using separate vials resulted in and overall average RSD = 4.7%, or s_p of 2.7 mmol/m^3. Elimination of one grossly differing pair brought the s_p down to 1.9 mmol/m^3. The CRM Bermuda Deep 12-00 averaged 46.1 ± 2.7 mmol/m^3 over the five analysis sets. The Low Carbon CRM averaged -0.6 ± 1.1 mmol/m^3.

See Table 10 below for notes on TOC analysis sets and **Appendix 5.2** for TOC data plots.

Table 10. TOC Analysis Sets

Analysis Set No.	Station	Sample No.	Notes
082007	LS08 LS17	1-23 1-24	This set started with 2 days of cleaning the Apollo system until it stabilized. The RmQ blanks were still a bit high at the start, likely due to the use of the alternate water system, as the usual one was at sea. After running the RmQ system all day, the blanks did come down. For the first samples, however, the Low C CRM values were used as a blank correction. Towards the end, while running LS17 overnight, the tin scrubber started clogging up with moisture, and samples #13-24 saw lengthening peaks and consequent rising peak areas. These latter samples were redone on the following set.
082507	LS17 LS20	13-24 2-24	This set had a few problems with changeable integration time due to moisture issues, but with all the blanks and DRS run it was possible to adjust for this. The LS17 samples were analysed in a more stable period, where blanks only decreased a bit as is usual with start-up, nevertheless, because they were repeated a few days after thawing and their initial analysis, they may not be as reliable. The LS20 samples 18 to 24 were analysed during the more problematic period at the end of the set.
090107	LS01 LS33	1A-1E 2-24	This analysis set ran very well, no problems encountered.
102907	LS01 LS27	1F-1J 1-24	This analysis set ran very well, no major problems encountered. Blanks were a bit higher than normal at start but gradually came down smoothly with time.

3.1.1.12 CDOM

Hydrocast samples (4 to 6 L) were collected into a pre-washed PET container and filtered immediately through precombusted (400 °C for 6 h) GF/F filters mounted in PET holders that were connected directly to the PET container. The first liters of filtrate were discarded. The CDOM samples were stored in precombusted (550 °C for 5 h) amber glass bottles. All samples were stored in darkness at 4 °C until analysis.

Absorbance of CDOM was measured by Celine Gueguen (IARC) on an UV/Visible spectrophotometer (Agilent 8453) with a 5 cm quartz cuvette using Milli-Q water as areference. Values of average absorbance at 650-700nm were set to zero to correct the spectra for refractive index effects. The measured absorbance was converted to absorption coefficient (m^{-1}) according to the equation: a355 = 2.303xA/L; where A is the absorbance and L the path-length of the optical cell in meters.

Fluorescence measurements (Ex/Em 370/460) were made with a FluoroMax 3 Jobin Yvon fluorometer equipped with two monochromators for both the excitation and the emission. Samples were contained in 1 cm path-length quartz cells. The recorded spectra were corrected for instrumental response. Milli-Q water was used as a blank and subtracted from sample spectra. All samples were normalized to the Raman area to account for lamp decay over time. Because of low absorbance, no inner filter effect correction was applied.

See **Appendix 5.3** for CDOM data plots.

3.1.1.13 Surface samples

The surface samples collected during the cruise fall into two groups shown in the map below (Figure 15). The first group of samples was taken at Rosette stations to enhance the vertical profile by adding an extra water sample from the surface. A bucket was lowered over the side from the stern of the ship during the station, collecting water from approximately 1 m depth. Most properties were then subsampled from the bucket (salinity, chlorophyll, oxygen, nutrients, barium, $\delta^{18}O$ and less frequently DIC and alkalinity). CTD data from 1 m depth were later added to the data spreadsheet to match these water samples. These 19 samples are numbered within the scheme of the samples drawn from the Rosette. It should be noted that the quality of these sample may be lower than those sample from the Niskin bottles due to the sampling method. The second group of samples was collected between stations by Naoaki Uzuka (IARC) while the ship was underway (at a reduced speed for sampling). A submersible pump was lowered into the water from the stern of the ship and water pumped up to the deck into a bottle. Salinity and $\delta^{18}O$ were measured from these 76 samples. These samples have their own numbering scheme and do not have associated CTD data.

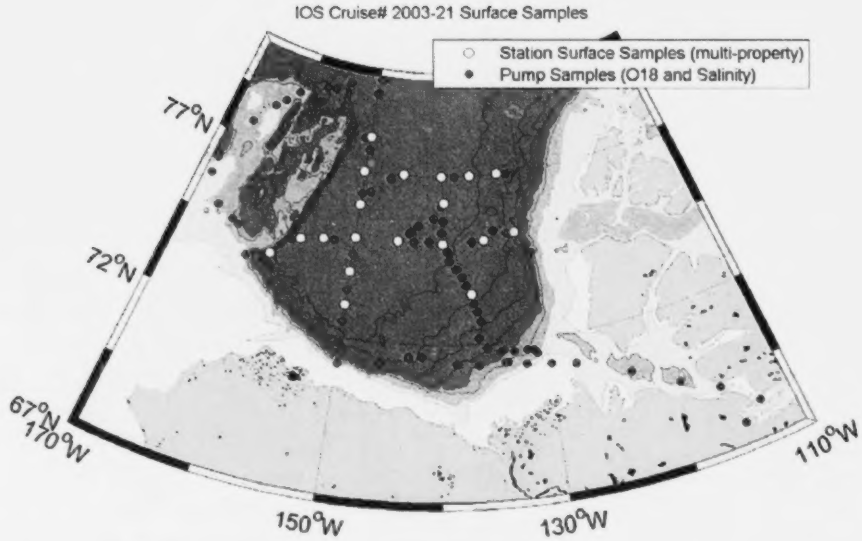


Figure 15. Surface sample locations for the two types of surface samples.

3.2 OTHER FIELD SAMPLING

Short summaries of additional data collected but not included in this report are given below.

3.2.1 XCTD

An XCTD (eXpendable Conductivity Temperature and Depth) survey was conducted through Davis Srait and Baffin Bay by Hirokatsu Uno and continued through the Canada Basin cruise. The sensors, made by Tsurumi Seiki and supplied by Koji Shimada of JAMSTEC, were deployed from the stern of the ship via a hand held launcher. The probes fell freely in the water measuring temperature and conductivity every 0.15 m from the surface down to 1100 m. Data were transmitted to the ship during the freefall by a thin conducting wire extending from the XCTD to an onboard computer. To prevent sea ice from cutting the thin transmission wire, the ship slowed to 12 knots for the deployment in open water areas and completely stopped in heavy ice areas. It took 5 minutes for the XCTD to descend from the surface to 1100 m.
There were 118 XCTD stations during this cruise. Locations are listed in **Appendix 2**. The accuracy of XCTD is ±0.02 degrees in temperature, ±0.03 mS/cm in conductivity (approximately ±0.04 PSU in salinity) and ±5 to 20 m in depth. The initial salinity accuracy of XCTD was improved, corrected to ±0.01 PSU, using the calibrated CTD data of this cruise. The salinity data were corrected by applying an offset to match the XCTD with the CTD in the deeper water.

For more information and data see the JAMSTEC website: http://www.jamstec.go.jp/e/.

3.2.2 Moorings and Buoys

As part of JWACS two JAMSTEC moorings, deployed in 2002 near the Northwind Ridge (NWR02 and NWR03) and Northwind Abyssal Plain (CPH02 and CPH03), were recovered and redeployed and two new JAMSTEC stationary moorings were deployed near Hanna Shoal on the Chukchi Shelf (HC03). One JAMSTEC J-CAD drifting ice buoy was successfully recovered near the northern tip of the Northwind Ridge and one new J-CAD buoy was deployed in the central southern Canada Basin.

As part of BGFE, three stationary bottom-tethered moorings (including MMPs, ULSs and BPRs) and four drifting Ice Beacons (measuring seawater temperature and salinity at 3 depths in the upper 40 m) were deployed by the WHOI team in the deep central Canada Basin. Details concerning the mooring hardware, instrumentation, and deployment procedure in 2003 and information on the Ice Beacons are given in WHOI Technical Report WHOI-2004-1 (Ostrom

et al. 2003). More information, data from the BG moorings and buoys, as well as dispatches from the 2003 cruise are available at: http://www.whoi.edu/beaufortgyre.

The Canadian Basin Observing System (CABOS) IARC mooring deployed in 2002 was recovered, serviced and re-deployed in 1100 m of water in the southeast corner of the Canada Basin. The mooring measured temperature, salinity, pressure, and current using a MMP profiling between 50 m and 1050 m. For more information see the web page http://nabos.iarc.uaf.edu/.

A drifting buoy was deployed in support of the International Arctic Buoy Programme (IABP).

A stationary mooring and one drifting buoy were deployed in support of collaborative work between CRREL and IOS at Station LS15, on the slope south of the Chukchi Plateau. Co-funding was provided by NOAA and collaborators include Jackie-Richter Menge (CRREL), Don Perovich (CRREL), Jim Overland (NOAA) and Ron Lindsay (APL-UW).

See Table 11 below for details on mooring and buoy locations.

Table 11. Summary of mooring and buoy recoveries and deployments.

Station	Organization	Activity	Start Time (UTC)	Latitude (N)	Longitude (W)	Bottom Depth (m)
CABOS-1+ A45	IARC	Mooring-recovery	8/11/2003 17:00	71.3843	134.0633	1644
WH-M1	WHOI	Mooring-deploy	8/14/2003 18:20	75.0065	149.9792	3818
NWR02	JAMSTEC	Mooring-recovery	8/15/2003 14:30	74.4897	158.0315	1550
NWR03	JAMSTEC	Mooring-deploy	8/16/2003 0:23	74.4942	158.0430	1445
HC03	JAMSTEC	Mooring-deploy	8/16/2003 19:21	73.1442	160.5059	249
CPH02	JAMSTEC	Mooring-recovery	8/17/2003 13:30	74.3728	162.1482	1500
CPH03	JAMSTEC	Mooring-deploy	8/17/2003 20:13	74.3988	162.1564	1500
CRREL/ IOS	CRREL	Mooring-deploy	8/18/2003 15:16	75.1000	168.0000	166
JCAD	JAMSTEC	JCAD-recovery	8/22/2003 20:30	77.8250	153.7595	1635
WH-B1	WHOI	CRREL Ice Mass Balance Buoy (IMB-1) & WHOI Ice Buoy (WH-B1)	8/23/2003 0:30	77.8250	153.7595	~1635
WH-M2	WHOI	Mooring-deploy	8/24/2003 4:05	78.0249	149.8230	3822
WHOI-Buoy2	WHOI	Buoy-deploy	8/25/2003 18:00	76.8583	146.6833	___
WHOI-Buoy3	WHOI	Buoy-deploy	8/26/2003 12:30	77.1100	142.7950	___
WHOI-M3	WHOI	Mooring-deploy	8/27/2003 1:03	76.9876	139.9038	3705
WHOI-Buoy4	WHOI	Buoy-deploy	8/27/2003 3:00	76.8337	139.4968	___
JCAD deploy	JAMSTEC	JCAD-deploy	8/31/2003 18:00	76.2833	139.8333	~3620
IMB-2 buoy	JAMSTEC	Ice Mass Buoy deploy	8/31/2003 20:30	76.2833	139.8333	~3620
CABOS2	IARC	Mooring-deploy	9/3/2003 23:45	71.7779	131.8866	1573

3.2.3 Vertical Net Tows

Zooplankton sampling was conducted on board by Camile Coray, University of Alaska Fairbanks, using a modified Bongo net system. Two large bongo frames held nets, one 150 µm and one 236 µm mesh and a second pair of smaller frames, fitted with 53 µm mesh nets, were attached perpendicular to the bongo frames. The four nets contained unidirectional flowmeters to measure the amount of water flowing through the nets. The vertical net tows were 100 m deep, with casts to 500 m when time allowed. At each station there were at least two tows. See Table 12 below for location of bongo net casts.

Samples from the first tow were preserved in formalin, individually for the 150 and 236 µm mesh nets whereas the samples from the 53 µm nets were combined into one sample. From the second tow, the 236 µm net sample and the combined 53 µm net sample were preserved in 100% ethanol, and the 150 µm net sample was washed with 4% ammonium formate and dried at 50 °C for 24 hours. If there was a third cast to 500 m, one 53 µm sample was preserved in formalin, the other in ethanol, the 150 µm preserved in formalin and the 236 µm preserved in ethanol.

The formalin samples are used for species identification and the ethanol samples are used for DNA sequence analysis. The dried sample provides a measurement of biomass. The samples from the 236 µm mesh were collected for John Nelson (IOS/UVic) and samples from the 150 µm and 53 µm mesh for Russ Hopcroft (UAF). The 53 µm ethanol sample were sent to the Census of Marine Life's DNA barcoding study. Census of Marine Life is an affiliated program of the International Council of Science, Scientific Committee on Oceanic Research.

Zooplankton identification was performed at Russ Hopcroft's lab; biomass bench sheets can be found in **Appendix 8**. For more information contact Russ Hopcroft at:

Institute of Marine Science
120 O'Neill
P.O. Box 757220
University of Alaska Fairbanks
Fairbanks, AK 99775-7220
Phone: (907) 474-7842
Fax: (907) 474-7204
hopcroft@ims.uaf.edu

Zooplankton Genetics

Mixed zooplankton samples were collected by vertical net hauls with a 236 micron net (see Table 13) and were preserved in 95% ethanol. Individual *Calanus glacialis* were identified from the mixed samples according to size and morphology according to Frost (1974), Fleminger & Hulsemann (1977) and Hirsche (1994). DNA was extracted by incubating individual zooplankters in 100 µL of 10% Chelex-100 (Biorad Corp.), 0.2% SDS and 0.4 mg/mL proteinase K for 2 hours at 55 °C then 95 °C for 15 minutes. The DNA sequence of a segment of the *16S* rRNA gene was determined by direct sequencing of the PCR product produced with primers:

16sarRNA (5' CGCCTGTTTAACAAAAACAT 3') (Palumbi & Benzie 1991)

16sb2rRNA (5' ATTCAACATCGAGGTCACAAAC 3') (Lindique et al. 2005).

Sequencing was carried out with an Applied Biosystems 3700 sequencer. The computer program PHRED/PHRAP (Ewing & Green 1998) was used for assembly of individual contigs from forward and reverse sequences and CONSED (Gordon et al. 1998) was used to check the individual consensus sequences. Comparison and trimming of each individual consensus sequence was carried out with SEQMAN 5.05, DNAstar Inc., Madison, Wisconsin.

For each individual specimen of *Calanus glacialis* 271 base pairs of the *16S* ribosomal RNA gene were sequenced. Twelve unique genetic haplotypes were observed in the 67 samples analysed (Table 14). The predominant haplotype in all samples was haplotype H1and which ranged from a frequency of 0.73 to 0.82 in the samples. All other haploytpes were found relatively infrequently among the samples with the exception of haplotype H4 which was found at a frequency of 0.20 in the sample from LS27. This data was published in:

Nelson, R.J., Carmack, E.C., McLaughlin, F.A. and Cooper, G.A. 2009. Penetration of Pacific zooplankton into the western Arctic Ocean tracked with molecular population genetics. *Mar. Ecol. Prog. Ser.* 381:129-138.

Table 12. Zooplankton bongo net cast locations.

Net Event	Station	Latitude (°N)	Longitude (°W)	Date (m/d/yr)	Approx. Bottom Depth (m)	Approx. Max Net Depth (m)
003	LS01	71.39	134.33	8/11/2003	1100	100
005	LS03	71.26	150.00	8/12/2003	551	100
008	LS04	71.50	150.00	8/12/2003	1925	500
012	LS06	73.00	150.00	8/13/2003	3700	100
013A	LS07	74.00	150.00	8/13/2003	3789	100
015	LS08	75.01	149.98	8/14/2003	3800	100
018	LS09	74.83	153.50	8/14/2003	3810	100
020A	LS12	74.00	158.81	8/16/2003	3300	100
024A/C	LS14	74.36	162.62	8/16/2003	1470	100 & 500
033	LS19	79.15	159.91	8/20/2003	3010	100
036	LS20	80.01	150.01	8/21/2003	3660	100
038	LS21	79.01	149.96	8/22/2003	3860	100
041	LS22	77.81	153.35	8/23/2003	1860	100
043	LS23	78.01	149.91	8/23/2003	3823	100
047	LS24	76.99	150.00	8/24/2003	3775	100
049	LS25	76.01	150.01	8/24/2003	3780	100
052	LS26	77.01	145.13	8/25/2003	3757	100
055	LS27	76.99	140.10	8/26/2003	3675	100
058	LS28	77.01	136.52	8/27/2003	3600	100
060	LS29	77.00	132.95	8/27/2003	3363	100
062	LS31	75.23	131.69	8/27/2003	2580	100
064	LS32	75.07	135.22	8/29/2003	3380	100
066	LS33	75.00	139.99	8/29/2003	3600	100
069	LS35	76.21	139.81	8/30/2003	3620	100
075	LS37	73.50	136.91	9/2/2003	3100	100

Table 13. Station information for zooplankton DNA analysis.

Station	N	Date	Lat (°N)	Long (°W)	Mesh[a]	Depth[b]	Bot.[c]
LS19	14	8/20/2003	79 08.81	159 54.37	236	100	3010
LS20	22	8/21/2003	80 00.77	150 00.33	236	100	3660
LS23	11	8/23/2003	78 00.33	149 54.90	236	100	3823
LS26	10	8/25/2003	77 00.79	145 00.78	236	100	3757
LS27	10	8/26/2003	76 59.23	140 06.08	236	100	3675

[a]plankton net mesh size in micrometers

[b]tow depth in meters

[c]bottom depth in meters

Table 14. Haplotype frequency and diversity for *Calanus glacialis*.

Sample	H1	H4	H7	H9	H10	H14	H16	H17	H19	H20	H24	H25
LS19	0.79	0.07	0	0	0	0	0	0	0.07	0.07	0	0
LS20	0.82	0	0.05	0	0.05	0	0.05	0.05	0	0	0	0
LS23	0.73	0	0	0	0	0.09	0	0	0	0	0.09	0.09
LS26	0.80	0	0	0.10	0.10	0	0	0	0	0	0	0
LS27	0.80	0.20	0	0	0	0	0	0	0	0	0	0

4. REFERENCES

Arar, E.J. and Collins, B.B. 1997. In vitro Determination of Chlorophyll a and Pheophytin in Marine and Freshwater Algae by Fluorescence. Revision 1.2 September 1997, US.EPA Method 445.0.

Barwell-Clarke, J. and Whitney, F. 1996. Institute of Ocean Sciences Nutrient Methods and Analysis. *Can. Technical Rep. Hydrogr. Ocean Sci.* 182:vi + 43 p.

Carpenter, J.H. 1965. The Chesapeake Bay Institute technique for the Winkler dissolved oxygen method. *Limnol. Oceanogr.* 10:141-3.

Dickson, A. 2001. Reference materials for oceanic measurements. *Oceanography.* 14(4):21-22.

Dickson, A.G., Afghan, J.D. and Anderson, G.C. 2003. Reference for oceanic CO_2 analysis: a method for the certification of total alkalinity. *Mar. Chem.* 80(2-3):185-197.

DOE. 1994. *In*: Dickson, A.G. and Goyet, C. (Eds.). Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Sea Water, Version 2. ORNL/CDIAC-74.

Edmonds, H.N., Smith, J.N., Kilius, L.R., Livingston, H.D. and Edmond, J.M. 1998. ^{129}I in archived seawater samples: Source functions and tracer comparisons. *Deep-Sea Research I.* 45(6):1111-1125.

Ewing, B. and Green, P. 1998. Base calling of automated sequencer traces using phred II. Error probabilities. *Genome Res.* 8:186-194.

Falkner, K.K., MacDonald, R.W., Carmack, E.C. and Weingartner, T. 1994. The potential of barium as a tracer of Arctic water masses. p. 63-76. *In:* O.M. Johannessen, R.D. Muench and J.E. Overland [eds.]. The Polar Oceans and Their Role in Shaping the Global Environment: The Nansen Centennial Volume, AGU Geophys. Monograph Series, AGU Books, Washington, DC.

Fleminger, A. and Hulsemann, K. 1977. Geographical range and taxonomic divergence in North Atlantic Calanus (*C. Helgolandicus*, *C. finmarchicus* and *C. glacialis*). *Mar. Biol.* 40:233-248.

Frost, B.W. 1974. *Calanus marshallae*, a new species of calanoid copepod closely allied to the sibling species *C. finmarchicus* and *C. glacialis*. *Mar. Biol.* 26:77-99.

Gordon, D., Abajian, C. and Green, P. 1998. Consed: a graphical tool for sequence finishing. *Genome Res.* 8:195-202.

Hirche, H.J. 1994. The Northeast Water Polynya, Greenland Sea III. Meso and macrozooplankton distribution and production of dominant herbivorous copepods during spring. *Polar Biol.* 14:491-503.

JGOFS. 1994. Protocols for the Joint Global Ocean Flux Study (JGOFS) core measurements, Manual and guides 29, Scientific Committee on Ocean Research, United Nations Educational, Scientific and Cultural Organization, Paris, 170 pp.

Johnson, K.M., Wills, K.D., Butler, D.B., Johnson, W.K. and Wong, C.S. 1993. Coulometric total carbon dioxide analysis for marine studies: maximizing the performance of an automated gas extraction system and coulometric detector. *Mar. Chem.* 44:167-187.

Kemp, J., Newhall, K., Ostrom, W., Krishfield, R., and Proshutinsky, A. 2005. The Beaufort Gyre Observing System 2004: Mooring Recovery and Deployment Operations in Pack Ice; WHOI Technical Report WHOI-2005-5.

Krishfield, R., Doherty, K., Frye, D., Hammar, T., Kemp, J., Peters, D., Proshutinsky, A., Toole, J. and von der Heydt, K. 2006. Design and Operation of Automated Ice-Tethered Profilers for Real-time Seawater Observations in the Polar Oceans. WHOI-2006-11: 79 p.

Lewis, E.L. and Perkin, R.G. 1981. The Practical Salinity Scale 1978: conversion of existing data. *Deep Sea Res.* 28 A:307-328.

Lindeque, P.K., Hay, S.J., Heath, M.R., Ingvarsdottir, A., Rasmussen, J., Smerdon, G.R. and Waniek, J.J. 2005. Integrating conventional microscopy and molecular analysis to analyse the abundance and distribution of four Calanus congeners in the North Atlantic. *J. Plank. Res.* 28:221-238.

Minkley, B. and Chase, G. 1997. Dissolved Oxygen Determination Methods and Procedures. Institute of Ocean Sciences, July 30, 1997. Internal Document.

Nelson, R.J., Carmack, E.C., McLaughlin, F.A. and Cooper, G.A. 2009. Penetration of Pacific zooplankton into the western Arctic Ocean tracked with molecular population genetics. *Mar. Ecol. Prog. Ser.* 381:129-138.

Ostrom, W., Kemp, J., Krishfield, R. and Proshutinsky, A. 2004. Beaufort Gyre Freshwater Experiment: Deployment Operations and Technology in 2003. Technical Report of the Woods Hole Oceanographic Institution, WHOI-2004-01, 32 pp.

Palumbi, S.R. and Benzie, J. 1991. Large mitochondrial DNA differences between morphologically similar Penaeid shrimp. *Mol. Mar. Biol. and Biotech.* 1:27-34.

Seabird. 2008. Calculation of Calibration Coefficients for Sea Tech, Chelsea (Alphatracka) and WET Lab Cstar Transmissometers. Application Note No. 7.

Smith, J.N., Ellis, K.M. and Jones, E.P. 1990. Cesium-137 transport into the Arctic Ocean through Fram Strait. *Journal of Geophysical Research.* 95(C2):1693-1701.

Smith, J.N. and Ellis, K.M. 1995. Radionuclide tracer profiles at the CESAR Ice Station and Canadian Ice Island in the Western Arctic Ocean. Deep-Sea Research II. 42(6):1447-1470.

Smith, J.N., Ellis, K.M. and Kilius, L.R. 1998. 129I and 137Cs tracer measurements in the Arctic Ocean. Deep-Sea Research I. 45(6):959-984.

Smith, J.N., Ellis, K.M. and Boyd, T.M. 1999. Circulation features in the Central Arctic Ocean revealed by nuclear fuel reprocessing tracers from SCICEX 95 and 96, 1999. *Journal of Geophysical Research.* 104(C12):29,663-29,677.

Smith, J.N., Jones, E.P., Moran, S.B., Smethie Jr., W.M. and Kieser, W.E. 2005. ^{129}I/CFC-11 Transit times for Denmark Strait Overflow Water in the Labrador and Irminger Seas. *Journal of Geophysical Research.* 110, C05006, doi:10.1029/2004JC002516.

Strickland, J.D.H. and Parsons, T.R. 1972. A practical handbook of seawater analysis. Fisheries Research Board of Canada.

5. RELATED DATA REPORTS IN THE CANADIAN DATA REPORT OF HYDROGRAPHY AND OCEAN SCIENCES SERIES

Birch, J.R., Lemon, D.D., Fissel, D.B., Melling, H. 1987. Arctic data compilation and appraisal. Volume 12, Beaufort Sea and Amundsen Gulf : physical oceanography : temperature, salinity, currents, water levels and waves : revised and updated to include 1914 through 1986. *Can. Data Rep. Hydrogr. Ocean Sci.* **5**(12): 469 p.

Carmack, E., Papadakis, J.E., Macdonald, D.M., and Macdonald, R.W. 1989. NOGAP B.6. Volume 6, Physical data collected in the Beaufort Sea, summer, 1987. *Can. Data Rep. Hydrogr. Ocean Sci.* **60**(6): 219 p.

Carmack, E.C., Macdonald, R.W., O'Brien, M., Pearson, R., Timmermans, L., Sieberg, D., Von Hardenberg, B., Sutherland, N., Tuele, D., Jackson, F., and L. White, L. 1996. Physical and chemical data collected in the Beaufort Sea and the Canadian archipelago, August-September 1995. *Can. Data Rep. Hydrogr. Ocean Sci.* **147**: 281 p.

Cornford, A.B., Lemon, D.D., Fissel, D.B., Melling, H., Smiley, B.D., Herlinveaux, R.H., and Macdonald, R.W. 1982. Arctic data compilation and appraisal. Volume 1, Beaufort Sea: physical oceanography : temperature, salinity, currents and water levels. *Can. Data Rep. Hydrogr. Ocean Sci.* **5**(1): 279 p.

Cuypers, L.E., Blaskovich, A.W., Carmack, E.C., and R.W. Macdonald, R.W. 1988. NOGAP B.6: physical data collected in the Beaufort Sea, September 1986. *Can. Data Rep. Hydrogr. Ocean Sci.* **59**: 149 p.

Macdonald, D.M., Cuypers, L.E., McCullough, D., Carmack, E., and Macdonald, R.W. 1988. NOGAP B.6. Volume 2, Physical data collected in the Beaufort Sea, March-June 1987. *Can. Data Rep. Hydrogr. Ocean Sci.* **60**(2): 157 p.

Macdonald, R.W., Iseki, K., Carmack, E.C., Macdonald, D.M., O'Brien, M.C., and McLaughlin, F.A. 1988. Data report: NOGAP B.6 : Beaufort Sea oceanography, September, 1986. *Can. Data Rep. Hydrogr. Ocean Sci.* **58**: 68 p.

Macdonald, R.W., Iseki, K., O'Brien, M.C., McLaughlin, F.A., McCullough, D., Macdonald, D.M., Carmack, E.C., Adams, H., Yunker, M., Miskulin, G., and Buckingham, S. 1988. NOGAP B.6. Volume 4, Chemical data collected in the Beaufort Sea, Summer, 1987. *Can. Data Rep. Hydrogr. Ocean Sci.* **60**(4): 103 p.

Macdonald, R.W., Iseki, K., O'Brien, M.C., McLaughlin, F.A., McCullough, D., Macdonald, D.M., Carmack, E.C., Yunker, M., Buckingham, S., and Miskulin, G. 1988. NOGAP B.6. Volume 5, Chemical data collected in the Beaufort Sea and Mackenzie River delta, March-July 1987. *Can. Data Rep. Hydrogr. Ocean Sci.* **60**(5): 55 p.

Macdonald, R.W., Carmack, E.C., O'Brien, M.C., McLaughlin, F.A., Minkley, B.G., and Berger-North, K. 1990. Oceanographic data collected from the Sir John Franklin in the Beaufort Sea, September 1989. *Can. Data Rep. Hydrogr. Ocean Sci.* **80**: 100 p.

Macdonald, R.W., Carmack, E.C., McLaughlin, F.A., Sieberg, D., O'Brian, M.C., Paton, D., Pearson, R., Liangfeng, Y., and Gobeil, C. 1991. Oceanographic data collected from the HENRY LARSEN in the Beaufort Sea, August-September 1990. *Can. Data Rep. Hydrogr. Ocean Sci.* **97**: 142 p.

Macdonald, R.W., Pearson, R., Sieberg, D., McLaughlin, F.A., O'Brien, M.C. Paton, D.W., Carmack, E.C., Forbes, J.R., and Barwell-Clarke, J. 1992. NOGAP B.6, Physical and chemical data collected in the Beaufort Sea and Mackenzie River delta, April-May 1991. *Can. Data Rep. Hydrogr. Ocean Sci.* **104**: 154 p.

Macdonald, R.W., Sieberg, D., Pearson, R., Paton, M., O'Brien, M.C., McLaughlin, F.A., and Carmack, E.C. 1992. Oceanographic data collected from the Henry Larsen in the Beaufort Sea, September 1991. *Can. Data Rep. Hydrogr. Ocean Sci.* **112**: 108 p.

Macdonald, R.W., O'Brien, M., Carmack, E.C., Pearson, R., McLaughlin, F.A., Sieberg, D., Barwell-Clarke, J., Paton, D.W., and Tuele, D. 1995. Physical and chemical data collected in the Beaufort, Chukchi and east Siberian seas, August-September 1993. *Can. Data Rep. Hydrogr. Ocean Sci.* **139**: 287 p.

McLaughlin, F., Carmack, E., O'Brien, M., Adamson, L., Barwell-Clarke, J., Gatien, G., Hingston, M., Johnston, P., May, B., Melling, H., Poliquin, M., Riedel, D., Sieberg, D., Tuele, D., VanHardenberg, B., Walsh, D., Welch, B., and Welch, C. 2008. Physical and Chemical Data from the Canadian Arctic Archipelago, August 28 to September 18, 1997. Can. Data Rep. Hydrogr. Ocean Sci. **176**: vi + 140 p.

McLaughlin, F., Carmack, E.C., Zimmermann, S., Sieberg, D., White, L., Barwell-Clarke, J., Steel, M., and Li, W.K.W. 2008. Physical and chemical data from the Canada Basin, August 2004. *Can. Data Rep. Hydrogr. Ocean. Sci.* **140**: vi + 185 p.

McLaughlin, F., Carmack, E., O'Brien, M., Bacle, J., Gatien, G., Tuele, D., White, L., Moody, G., Balsom, A., and Corkum, M. 2009. Physical and Chemical Data from the Beaufort Sea and Western Canadian Arctic Archipelago, September 2 to 16, 2000. Can. Data Rep. Hydrogr. Ocean Sci. **180**: viii + 167 p.

McLaughlin, F., Carmack, E., O'Brien, M., Barwell-Clarke, J., Gatien, G., Harris, J., Itoh, M., Lichiota, G., Shimada, K., Sieberg, D., Steel, M., Toews, S., VanHardenberg, B., White, L., Smith, J., Zimmermann, S., and Corkum, M. 2009. Physical and Chemical Data from the Beaufort Sea and Canada Basin, August 16 to September 5, 2002. *Can. Data Rep. Hydrogr. Ocean Sci.* **181**: vii + 223 p.

Paton, D.W., Abehennah, A., Grieve, W., and Macdonald, R.W. 1994. NOGAP B.6, oxygen isotope data from water and ice cores from the Beaufort Sea, September 1990 and May 1991. *Can. Data Rep. Hydrogr. Ocean Sci.* **134**: 118 p.

Paton, D.W., Knight, V., and Macdonald, R.W. 1997. NOGAP B.6 oxygen isotope data from water and ice cores from the Beaufort Sea, May 1992. *Can. Data Rep. Hydrogr. Ocean Sci.* **149**: 23 p.

Pearson, R., O'Brien, M., Sieberg, D., McLaughlin, F.A., Paton, D.W., Tuele, D., Barwell-Clarke, J., Carmack, E.C., Macdonald, R.W., and Galbraith, M. 1994. NOGAP B.6, Physical and chemical data collected in the Beaufort Sea and Mackenzie River delta, April-May and September, 1992, and ice core data collected in 1991-1992. *Can. Data Rep. Hydrogr. Ocean Sci.* **129**: 199 p.

Thomas, D.J., Macdonald, R.W., and Cornford, A.B. 1982. Arctic data compilation and appraisal. Volume 2, Beaufort Sea: chemical oceanography. *Can. Data Rep. Hydrogr. Ocean Sci.* **5**(2): 243 p.

Thomas, D.J., Noone, F., Blyth, A., and Smiley, B.D. 1990. Arctic data compilation and appraisal. Volume 20 (Part 2), Beaufort Sea: chemical oceanography: hydrocarbons, metals, pigments, nutrients, oxygen and others : revised and updated to include 1950 through 1987. *Can. Data Rep. Hydrogr. Ocean Sci.* **5**(20): Pt 1&2 2 v.

Woods, S.M., and Smiley, B.D. 1987. Arctic data compilation and appraisal. Volume 9, Beaufort Sea: biological oceanography: bacteria, plankton, epontic community, 1914 to 1985. *Can. Data Rep. Hydrogr. Ocean Sci.* **5**(9): 394 p.

APPENDIX

Table of Contents – Appendix

List of Tables – Appendix

1. SCIENCE PARTICIPANTS

Table 1. Onboard Science Team

Name	Affiliation	Position
Bon van Hardenberg	DFO (IOS)	Expedition Leader
Koji Shimada	JAMSTEC	JWACS Coordinator
Andrey Proshutinsky	WHOI	BGFE Coordinator
Doug Sieberg	DFO (IOS)	Moorings, Logistics, Salts
Motoyo Itoh	JAMSTEC	CTD/Rosette
Valerie Forsland	DFO (IOS)	Chemistry Coordinator, CO_2 sampling
Linda White	DFO (IOS)	Nutrient Analysis
Mary Steel	DFO (IOS)	Dissolved Oxygen Analysis
Wendy Richardson	DFO (IOS)	CFCs, Chlorophyll Analysis
Hirokatsu Uno	JAMSTEC	Moorings, XCTD
Kiyoshi Hatakeyama	JAMSTEC	Moorings
Rick Krishfield	WHOI	Moorings
Will Ostrum	WHOI	Moorings
Céline Guéguen	IARC	CDOM, DOC, POC, CHO, Chlorophyll
Naoaki Uzuka	IARC	^{18}O Sampling
Camille Coray	UAF	Zooplankton Sampling

Table 2. Principal Investigators

Name	Affiliation	Program
Fiona McLaughlin	DFO (IOS)	Program Lead CTD and chemistry
Eddy Carmack	DFO (IOS)	CTD and drifter bottles
Andrey Proshutinsky	WHOI	WHOI moorings
Koji Shimada	JAMSTEC	XCTD and JAMSTEC moorings and buoys
John Smith	DFO (BIO)	^{129}I and ^{137}Cs samples
Chris Guay	OSU	Barium samples
Noriyuki Tanaka	IARC	^{18}O samples
C.S. Wong	IOS	^{13}C samples
Peter Schlosser / Bob Newton	LDEO	Helium/Tritium samples
Celine Gueguen	Trent (was IARC)	CDOM samples
Russ Hopcroft	UAF	Zooplankton net tows
Igor Polyakov	IARC	CABOS mooring
Laodong Guo	IARC	POC/DOC/CHO samples

Table 3. Affiliation Abbreviation

BIO	DFO, Bedford Institute of Oceanography, Nova Scotia
DFO	Department of Fisheries and Oceans Canada
IARC	International Arctic Research Center, Alaska
IOS	DFO, Institute of Ocean Sciences, British Columbia
JAMSTEC	Japan Agency for Marine-Earth Science Technology, Japan
LDEO	Lamont Doherty Earth Observatory, New York
OSU	Oregon State University, Oregon
Trent	Trent University, Ontario
UAF	University of Alaska Fairbanks, Alaska
WHOI	Woods Hole Oceanographic Institution, Massachusetts

2. LOCATION OF SCIENCE STATIONS

Station locations and activities are listed below. They include CTD/Rosette, zooplankton vertical net and over-the-side bucket casts, as well as mooring and buoy recovery and deployments.

Table 4. A list of the CTD/Rosette, vertical net haul, mooring and buoy stations.

CTD Cast No.	Station	Latitude (N)	Longitude (W)	Date & Start Time (UTC)	Station Depth (m)	Bottom Depth (m)	Activity
	Kugluktuk	68	115		----	----	Start Science
	CABOS-1+A45	71.3843	134.0633		1634	1644	Mooring-recovery
1	LS01	71.3915	133.9967	8/11/2003 20:38	1146	1151	CTD/Rosette & Bongos
	TEST-CTD	71.6233	143.2167	8/12/2003 14:30			Test cast for CTD system
2	LS02	71.1998	149.9987	8/13/2003 0:54	68	73	CTD/Rosette
3	LS03	71.2635	149.9998	8/13/2003 2:52	551	556	CTD/Rosette & Bongos
4	LS04	71.4995	150.0027	8/13/2003 5:11	1925	1930	CTD/Rosette & Bongos (500m)
5	LS05	72.0055	149.9925	8/13/2003 9:04	3135	3140	CTD/Rosette
6	LS06	73.0002	149.9967	8/13/2003 15:22	3695	3700	CTD/Rosette & Bongos
7	LS07	74	149.9983	8/13/2003 22:44	3780	3785	CTD/Rosette & Bongos
8	LS08	75.011	149.9767	8/14/2003 6:02	3896	3901	CTD/Rosette & Bongos
9	LS08-2	75.0088	150.0169	8/14/2003 11:39	3795	3800	CTD/Rosette
	WH-M1	75.0065	149.9792	8/14/2003 18:20	----	3818	Mooring-deploy
10	LS09	74.8334	153.5012	8/15/2003 0:19	3913	3918	CTD/Rosette & Bongos
11	LS10	74.6658	156.0046	8/15/2003 6:17	3845	3850	CTD/Rosette
	NWR02	74.4897	158.0315	8/15/2003 14:30	----	1550	Mooring-recovery
12	LS11	74.492	158.0196	8/15/2003 16:46	1470	1475	CTD/Rosette
	NWR03	74.4942	158.043	8/16/2003 0:23	----	1445	Mooring-deploy
13	LS12	73.9955	158.827	8/16/2003 5:38	3475	3480	CTD/Rosette & Bongos
14	LS13	73.1655	160.4836	8/16/2003 13:27	284	289	CTD/Rosette
	HC03	73.1442	160.5059	8/16/2003 19:21	----	249	Mooring-deploy
15	LS14	74.0311	162.062	8/17/2003 2:18	1475	1480	CTD/Rosette & Bongos (100m & 500m)

CTD Cast No.	Station	Latitude (N)	Longitude (W)	Date & Start Time (UTC)	Station Depth (m)	Bottom Depth (m)	Activity
	CPH02	74.3728	162.1482	8/17/2003 13:30	----	1500	Mooring-recovery
	CPH03	74.3988	162.1564	8/17/2003 20:13	----	1500	Mooring-deploy
16	LS15	75.0998	167.9972	8/18/2003 12:12	152	157	CTD/Rosette
	CRREL/ IOS	75.1	168	8/18/2003 15:16	----	166	Mooring-deploy
17	LS16	76.4158	168.6639	8/19/2003 0:49	280	290	CTD/Rosette
18	LS17	76.8143	168.0642	8/19/2003 5:35	2465	2475	CTD/Rosette
19	LS18	77.8655	165.2412	8/19/2003 17:15	3315	3325	CTD/Rosette
20	LS19-1	79.1469	159.9061	8/20/2003 12:31	3790	3800	CTD/Rosette & Bongos
21	LS19-2	79.1473	159.8828	8/20/2003 13:55	3790	3800	CTD/Rosette
22	LS20	80.0186	150.0978	8/21/2003 11:36	3714	3724	CTD/Rosette
23	LS20-2	80.0128	150.0055	8/21/2003 13:14	3714	3724	CTD/Rosette & Bongos
24	LS21	79.0105	149.957	8/22/2003 5:49	3709	3719	CTD/Rosette & Bongos
	JCAD*	77.825	153.7595	8/22/2003 20:30	----	1635	JCAD-recovery
25	LS22	77.8107	153.3529	8/23/2003 0:45	3714	3724	CTD/Rosette (same time) & Bongos
	WH-B1, IMB-1	77.825	153.7595	8/23/2003 0:30	---		CRREL Ice Mass Balance Buoy & WHOI Ice Buoy
26	LS23	78.0054	149.9149	8/23/2003 20:06	1551	1561	CTD/Rosette & Bongos
	WH-M2	78.0249	149.823	8/24/2003 4:05	----	3822	Mooring-deploy
27	LS24	76.9941	150.1016	8/24/2003 14:15	3815	3825	CTD/Rosette & Bongos
28	LS25	76.0116	150.0064	8/25/2003 0:35	3824	3829	CTD/Rosette & Bongos
	WHOI-Buoy2	76.8583	146.6833	8/25/2003 18:00	----	---	Buoy-deploy
29	LS26	77.0131	145.0123	8/25/2003 21:29	3787	3792	CTD/Rosette & Bongos
	WHOI-Buoy3	77.11	142.795	8/26/2003 12:30	----	----	Buoy-deploy
30	LS27	76.9872	140.1013	8/26/2003 18:16	3721	3726	CTD/Rosette & Bongos
	WHOI-M3	76.9876	139.9038	8/27/2003 1:03	----	3705	Mooring-deploy
	WHOI-Buoy4	76.8337	139.4968	8/27/2003 3:00	----	----	Buoy-deploy
31	LS28	77.0113	136.5164	8/27/2003 13:02	3632	3637	CTD/Rosette & Bongos
32	LS29	77.002	132.9534	8/27/2003 20:37	3370	3375	CTD/Rosette & Bongos

CTD Cast No.	Station	Latitude (N)	Longitude (W)	Date & Start Time (UTC)	Station Depth (m)	Bottom Depth (m)	Activity
33	LS30	76.9634	131.8707	8/28/2003 0:57	3211	3216	CTD/Rosette + ROV
34	LS31	75.2318	131.6894	8/29/2003 0:14	2612	2617	CTD/Rosette & Bongos
35	LS32	75.0743	135.2192	8/29/2003 8:57	3406	3411	CTD/Rosette & Bongos
36	LS33	75.0703	140.0101	8/29/2003 20:05	800	3600	partial cast-CTD failed; Bongos
37	LS33+1/3	75.0635	141.5535	8/30/2003 0:43	1200	3600	partial cast-CTD test
38	LS33+2/3	75.0449	143.2812	8/30/2003 5:00	1100	3600	partial cast-CTD test
39	LS34	75.0633	145.0619	8/30/2003 9:43	3748	3768	CTD/Rosette
40	LS35	76.209	139.8262	8/31/2003 2:45	800	3620	CTD/R (Cesium)
41	LS35-2	76.2121	139.8134	8/31/2003 4:09	3615	3620	CTD/Rosette & Bongos
	JCAD deploy	76.2833	139.8333	8/31/2003 18:00	----	----	JCAD-deploy
	IMB-2 buoy	76.2833	139.8333	8/31/2003 20:30	----	----	Ice Mass Buoy deploy
42	LS33	75.0013	140.0077	9/2/2003 2:48	800	3585	CTD/R (Cesium)
43	LS33-2	74.9966	139.9896	9/2/2003 4:04	3617	3622	CTD/Rosette
44	LS36	74.247	138.5149	9/2/2003 13:34	1600	3400	CTD/Rosette (D.O.)
45	LS37	73.4985	136.9133	9/2/2003 20:55	3128	3133	CTD/Rosette (STN-A) & Bongos
46	LS38	72.6661	136.1659	9/3/2003 4:50	1600	2585	CTD/Rosette (D.O.)
47	LS39	71.7673	131.8315	9/3/2003 22:35	1102	1107	CTD
	CABOS2	71.7779	131.8866	9/3/2003 23:45	1563	1573	Mooring-deploy
	Kugluktuk	68	115	9/5/2003 16:00	----	----	----

Table 5. XCTD cast locations – Halifax to Kugluktuk (Stations 1 to 31).

Station	Start				Depth (m)
	Date (yy/mm/dd)	Time	Latitude (N)	Longitude (W)	
1	03/08/02	05:32	63 - 59.70	55 - 01.61	—
2	03/08/02	07:18	64 - 20.04	55 - 33.28	—
3	03/08/02	09:03	64 - 40.05	56 - 05.57	1,200
4	03/08/02	10:48	64 - 59.95	56 - 38.72	672
4	03/08/02	10:54	65 - 00.93	56 - 40.46	595
5	03/08/02	12:30	65 - 20.00	57 - 11.09	—
6	03/08/02	14:09	65 - 37.97	57 - 43.87	575
7	03/08/02	15:51	66 - 00.18	58 - 16.59	541
8	03/08/02	17:31	66 - 20.08	58 - 49.47	620
9	03/08/02	19:15	66 - 39.41	59 - 24.00	643
10	03/08/02	21:00	66 - 59.87	59 - 54.29	925
11	03/08/02	23:11	67 - 20.13	60 - 35.33	980
12	03/08/03	00:51	67 - 40.52	61 - 00.78	1,500
13	03/08/03	04:48	68 - 20.32	61 - 46.88	1,750
14	03/08/03	08:13	69 - 00.13	62 - 29.78	1,870
15	03/08/03	11:21	69 - 40.07	63 - 15.41	1,935
16	03/08/03	14:02	70 - 20.08	64 - 00.62	2,035
17	03/08/03	16:37	71 - 00.35	64 - 45.72	2,075
18	03/08/03	19:13	71 - 40.41	65 - 28.78	2,290
19	03/08/03	21:47	72 - 20.00	66 - 15.31	2,330
20	03/08/04	00:23	73 - 00.13	67 - 01.10	2,275
21	03/08/04	02:04	73 - 07.57	68 - 30.17	2,150
22	03/08/04	03:51	73 - 18.09	70 - 00.76	1,675
23	03/08/04	04:59	73 - 24.03	71 - 00.40	1,250
24	03/08/04	06:06	73 - 30.11	72 - 00.64	1,080
25	03/08/04	07:11	73 - 36.26	72 - 59.63	860
26	03/08/04	08:14	73 - 42.05	73 - 59.75	875
27	03/08/04	09:49	73 - 51.15	75 - 30.00	920
28	03/08/04	11:35	74 - 00.05	76 - 59.80	855
29	03/08/04	14:36	74 - 04.47	80 - 00.38	780
30	03/08/04	19:37	74 - 11.65	84 - 59.94	530
31	03/08/05	02:49	74 - 21.33	89 - 59.98	290

Table 6. XCTD cast locations in the Canada Basin (Stations 32 to 118).

Station	Start				Depth (m)
	Date (yy/mm/dd)	Time	Latitude (N)	Longitude (W)	
32	03/08/12	00:19	71 - 19.42	135 - 11.72	1,100
33	03/08/12	02:15	71 - 21.66	136 - 41.44	1,700
34	03/08/12	04:15	71 - 19.43	137 - 39.77	1,750
35	03/08/12	06:14	71 - 26.38	138 - 41.33	-
36	03/08/12	08:29	71 - 27.97	139 - 52.61	-
37	03/08/12	11:09	71 - 31.24	141 - 21.16	-
38	03/08/12	13:22	71 - 42.68	142 - 42.58	2,950
39	03/08/12	15:58	71 - 29.88	143 - 41.43	3,100
40	03/08/12	18:02	71 - 25.88	145 - 12.76	-
41	03/08/12	20:25	71 - 19.57	146 - 58.98	2,950
42	03/08/12	22:23	71 - 14.78	148 - 24.64	2,950
43	03/08/13	12:52	72 - 29.03	150 - 01.28	-
44	03/08/13	19:47	73 - 29.42	150 - 02.45	3,760
45	03/08/14	02:48	74 - 29.72	149 - 57.64	3,770
46	03/08/14	22:02	74 - 54.95	151 - 45.40	3,800
47	03/08/15	04:34	74 - 41.26	154 - 42.46	3,800
48	03/08/15	10:43	74 - 37.67	156 - 44.63	3,790
49	03/08/15	11:45	74 - 32.56	157 - 14.06	3,790
50	03/08/15	12:23	74 - 29.15	157 - 42.02	-
51	03/08/16	03:54	74 - 20.46	158 - 45.40	1,510
52	03/08/16	04:42	74 - 09.76	158 - 41.88	1,880
53	03/08/16	09:50	73 - 47.69	159 - 15.65	2,980
54	03/08/16	10:59	73 - 35.33	159 - 44.40	2,250
55	03/08/16	12:06	73 - 22.11	160 - 05.72	1,320
56	03/08/16	21:44	73 - 27.61	160 - 58.79	385
57	03/08/16	23:04	73 - 45.82	161 - 21.58	750
58	03/08/17	00:24	74 - 02.92	161 - 45.74	430
59	03/08/17	23:29	74 - 29.00	163 - 07.42	-
60	03/08/18	01:50	74 - 35.89	164 - 00.07	780
61	03/08/18	06:16	74 - 51.07	166 - 00.20	450
62	03/08/18	20:31	75 - 59.71	168 - 25.42	450
63	03/08/18	21:37	76 - 07.28	168 - 26.70	-
64	03/08/18	21:47	76 - 07.07	168 - 23.54	1,155
65	03/08/18	22:57	76 - 14.62	168 - 31.35	-
66	03/08/19	08:04	76 - 55.14	167 - 39.84	1,070
67	03/08/19	11:19	77 - 16.55	166 - 44.17	625
68	03/08/20	02:11	78 - 30.03	162 - 41.52	701
69	03/08/20	06:41	78 - 54.34	160 - 50.04	965
70	03/08/20	08:53	79 - 01.17	160 - 22.45	-

Station	Start				Depth (m)
	Date (yy/mm/dd)	Time	Latitude (N)	Longitude (W)	
71	03/08/20	10:18	79 - 04.54	160 - 00.81	-
72	03/08/20	19:41	79 - 07.20	157 - 51.01	3,800
73	03/08/20	22:34	79 - 10.67	156 - 22.00	3,760
74	03/08/21	00:30	79 - 16.51	155 - 36.33	3,760
75	03/08/21	01:50	79 - 22.30	154 - 44.34	2,915
76	03/08/21	04:13	79 - 32.84	153 - 05.94	3,770
77	03/08/21	06:32	79 - 46.48	152 - 02.44	3,760
78	03/08/21	18:26	79 - 40.58	149 - 33.38	3,760
79	03/08/21	21:41	79 - 20.12	149 - 54.03	3,700
80	03/08/22	11:36	78 - 38.12	151 - 32.48	3,780
81	03/08/22	13:27	78 - 25.74	152 - 20.83	3,790
82	03/08/22	15:08	78 - 15.57	152 - 46.29	3,250
83	03/08/22	16:52	78 - 06.89	153 - 20.99	1,825
84	03/08/23	00:39	77 - 49.78	153 - 42.07	-
85	03/08/23	10:23	77 - 52.42	152 - 30.72	-
86	03/08/23	10:31	77 - 52.44	152 - 30.57	-
87	03/08/23	13:01	77 - 55.88	152 - 16.47	-
88	03/08/24	08:05	77 - 39.78	150 - 02.03	3,870
89	03/08/24	11:03	77 - 20.41	149 - 53.49	3,780
90	03/08/24	18:33	76 - 39.62	149 - 53.90	3,772
91	03/08/24	21:40	76 - 19.93	149 - 59.39	3,775
92	03/08/25	14:44	76 - 59.99	146 - 51.76	3,660
93	03/08/26	14:41	77 - 01.03	142 - 32.17	3,720
94	03/08/27	06:47	76 - 59.99	138 - 15.02	3,650
95	03/08/27	17:32	76 - 59.54	134 - 47.01	3,740
96	03/08/29	03:56	75 - 13.61	132 - 34.07	2,700
97	03/08/29	05:33	75 - 07.91	133 - 27.33	3,150
98	03/08/29	14:01	75 - 02.62	136 - 39.59	3,405
99	03/08/29	17:08	75 - 02.55	138 - 19.55	3,460
100	03/08/30	15:23	75 - 17.44	143 - 49.02	3,700
101	03/08/30	19:02	75 - 30.77	142 - 52.73	3,800
102	03/08/30	22:08	75 - 45.09	141 - 03.57	3,670
103	03/08/31	00:49	76 - 05.87	140 - 05.93	3,645
104	03/09/01	22:17	75 - 40.14	139 - 58.33	-
105	03/09/02	00:31	75 - 19.06	140 - 07.17	3,620
106	03/09/02	08:24	74 - 45.71	139 - 30.14	3,540
107	03/09/02	08:38	74 - 45.63	139 - 29.83	3,540
108	03/09/02	11:13	74 - 30.02	139 - 12.73	3,490
109	03/09/02	16:35	74 - 00.09	137 - 52.23	3,300
110	03/09/02	18:14	73 - 45.00	137 - 29.05	3,240

Station	Start				Depth (m)
	Date (yy/mm/dd)	Time	Latitude (N)	Longitude (W)	
111	03/09/03	00:33	73 - 13.00	136 - 45.10	2,840
112	03/09/03	02:39	72 - 57.54	136 - 26.21	2,810
113	03/09/02	10:22	72 - 10.02	136 - 27.21	2,300
114	03/09/02	14:00	71 - 51.67	135 - 39.42	2,050
115	03/09/03	17:25	71 - 42.03	134 - 22.98	1,415
116	03/09/03	20:17	71 - 42.44	133 - 06.85	1,250
117	03/09/04	02:35	71 - 41.12	131 - 10.95	793
118	03/09/04	03:26	71 - 34.00	130 - 55.02	486

3. CTD SETUP SPECIFICATIONS

The CTD system is described with relevant laboratory calibration dates.

Primary CTD SBE9plus s/n 9P28468-0724
Pressure s/n 90559, 29Oct02
Primary Temperature SBE 3plus s/n 03P4322, 8Mar03, 25May04
Secondary Temperature SBE 3plus s/n 03P4239, 7Mar03, 25May04
Primary Conductivity SBE 4 s/n 04-2809, 21Feb03, 25May04
Secondary Conductivity SBE 4 s/n 04-2810, 21Feb03, 25May04
Oxygen SBE 43 (pumped, configured with primary sensors)
s/n 430435 18Mar03, A/D voltage 6
Transmissometer Wetlabs C-Star s/nCST-662DR, 20Mar03, A/D voltage2
Fluorometer Seapoint (pumped, configured with secondary sensors) s/n 2569
gain set at 30x, A/D voltage 0
Benthos Altimeter #2110-B, A/D voltage 4 (JAMSTEC supplied)
Primary Pump s/n 053610
Secondary Pump s/n 053615
Water Sampler SBE 32 s/n 3235152
Deck Unit SBE 11plus s/n 11P31679-0649

Heights and Dimensions:
Measurements made in 2004, setup similar for 2003
Intake of temperature probes 7" above bottom of frame.
Temperature probes 8" apart
Transmissometer is mounted above the CTD, in obstructed flow.
Bottom of Niskin 10" above bottom of frame
Top of Niskin is 45" above bottom of frame
Bottle center is 10 + 35/2 = 27.5" above the bottom of the frame
Bottle center is 27.5"-7" = 20.5" (0.52m) above the sensors intakes.

4. CTD CAST NOTES

Table 7. Comments on CTD Casts.

CTD Cast	Comments on the casts :
1	LSO1 - 71 23.4N 133 79.8W, AUG11/03 2038 UTC, WATER DEPTH - 1100m ONLY 6 BOTTLES CLOSED, ICE FLOES, DOC- 10 SAMPLES FROM BOT#1
2	LS02 - 71 11.989N 149 59.920W, AUG.13/03 0054 UTC, WATER DEPTH - 73m CAST DEPTH - 68dbar, 13 OF 17 BOTTLES GOOD, ICE FLOES, FOG , CALM - ADD-ON
3	LS03 - 71 15.81N 149 59.99W AUG13/03 0252 UTC, NO chla 10 FRACTION, ADD-ON STATION, CALM, SNOW SQUALLS,INTERMITTANT SUN, SMALL ICE FLOES 3/10
4	LS04 - 71 29.97N 150 0016W AUG13/03 0511 UTC,WATER DEPTH - 1925m, NO WIND, OVERCAST AND SNOWING chla T ONLY,
5	LS05 - 72 00.33N 149 59.55W AUG13 1522 UTC, NO SAMPLES TAKEN, FAILED CAST
6	LS06 - 73 00.01N 149 59.80W AUG13 1522 UTC, WATER DEPTH - 3700m CAST DEPTH - 2000dbar 0m WITH BUCKET, SURFACE TEMP -1.0C, OVERCAST, COLDLARGE ICE FLOES WIND SLIGHT RIPPLE ON WATER, DOC IARC FROM POC IARC
7	LS07 - 74 00.00N 149 59.90W 2244 UTC WATER DEPTH - 3785m CAST DEPTH - 2000dbar 0m WITH BUCKET
9	LS08 -CAST 2 WATER DEPTH - 3800m CAST DEPTH - 800dbar SAMPLED ALL BOTTLES REGARDLESS IF LEAK - NOTED ON SAMPLES, ICE FLOES7/10,SNOW SQUALLS INTERMITTANT TEMP AIR -8C- 75 00.527N 150 01.016W AUG14/03 1139UTC, DOC-IOS SAMPLED LAST - CAST 1 - 75 00.66N 149 5
10	LS09 - 74 50.01N 153 03.070W 0019UTC, 15 AUG/03 WATER DEPTH - 3810m CAST DEPTH - 3918dbar 0m WITH BUCKET SURFACE TEMP -.07C
11	LS10 - 74 39.948N 156 00.277W 0617 UTC WATER DEPTH - 3845m(ALTMETER) 3780m (SOUNDING) CAST DEPTH - 3900dbar 0m WITH BUCKET SURFACE TEMP -0.4C
12	LS11 - 74 29.518N 158 01.175W 1646 UTC, 15 AUG/03 WATER DEPTH - 1470m CAST DEPTH - 1510dbar
13	LS12 - 73 59.730N 158 49.617W 0538 UTC 16 AUG/3 WATER DEPTH - 3300m CAST DEPTH - 3490dbar 0m WITH BUCKET
14	LS13 - 73 09.928N 160 29.013W 1327 UTC 16 AUG/03 WATER DEPTH - 280m CAST DEPTH - 289dbar
15	LS14 - 74 21.8660N 162 03.720W 0218 UTC 17 AUG/03 WATER DEPTH - 1470m CAST DEPTH - 1479dbar
16	LS15 - 75 05.989N 167 59.843W 1312UTC 17 AUG/03 WATER DEPTH - 157m CAST DEPTH - 159dbar FIRST TIME ALL THE OK NO LEAKS, CALAM WITH FOG, 3/10 COVER ICE FLOES
17	LS16 - 76 24.947N 168.39.831W 0049 UTC 19 AUG/03 WATER DEPTH - 2020m CAST DEPTH - 2056dbar POLAR BEAR @ SAMPLE #5 SO STOPPED TO VIEW~0.5HR, SOFT ICE, FOG AND COLD
18	LS17 - 76 46.857N 168 3.852W 0535 UTC 19 AUG/03 WATER DEPTH - 1600m CAST DEPTH - 1596dbar SLAINITY/O2 CALIBRATION CAST
19	LS18 - 77 51.9290N 165 14.473W 1715 UTC 19 AUG/03 WATER DEPTH - 478m CAST DEPTH - 477dbar
20,21	LS19 - CAST1 - 79 08.812N 159 54.365W 1231 20 AUG/03WATER DEPTH - 3010m CAST DEPTH - 800dbar - CAST2 - 79 08.837N 159 52.966W 1355UTC 20 AUG/03 WATER DEPTH - 3000m CAST DEPTH - 3094dbar OVERCAST, OPEN WATER WITH ICE IN DISTANCE, COLD WITH WIND RIPPLED ON

CTD Cast	Comments on the casts :
22,23	LS20 - 80 01.0016N 150 05.868W 1136 21AUG/03 WATER DEPTH - 3760m CAST 1 - CAST 2 - 80 00.77N 150 00.327W 1314 21AUG/03 WATER DEPTH - 3660m CAST DEPTH - 3871dbar
24	LS21 - 79 00.628N 149 57.421W 0549 22AUG/03 WATER DEPTH - 3860m CAST DEPTH - 3870dbar ICE FLOES - WIND 15-20KNOTS
25	LS22 - 77 48.643N 153 21.172W 0645 23AUG/03 WATER DEPTH - 1860m CAST DEPTH - 1887dbar - WIND SLIGHT - ICE FLOES
26	LS23 - 78 0.325N 149 54.891W 2006 23AUG/03 WATER DEPTH - 3823m CAST DEPTH - 3817dbar OVERCAST - LIGHT SNOW - LOW BREEZE SURFACE TEMP -1.4C Om WITH BUCKET
27	LS24 76 59.647N 150 6.097W 141524AUG/03 WATER DEPTH - 3775m CAST DEPTH - 3895dbar LARGE ICE PANS, SNOW, OVERCAST SLIGHT BREEZE, SURFACE TEMP - 0.8C Om WITH BUCKET
28	LS25 - 76 68.5N 150 00.386W 0035 25AUG/03 WATER DEPTH - 3780m CAST DEPTH - 3900dbar SURFACE TEMP -1.3C Om WITH BUCKET
29	LS26 - 77 00.788N 145 00.782W 2129 25AUG/03 WATER DEPTH - 3757 CAST DEPTH - 3850dbar Om WITH BUCKET SURFACE TEMP 0.0C
30	LS27 - 76 59.230N 140 06.079W 1816 26AUG/03 WATER DEPTH - 3675m CAST DEPTH - 3793dbar Om WITH BUCKET SURFACE TEMP -0.1C
31	LS28 - 77 00.679N 136 30. 984W 1302 27AUG/03 WATER DEPTH - 3600m CAST DEPTH - 3710dbar Om BUCKET
32	LS29 - 77 00.119N 132 57.201W 2037 27AUG/03 WATER DEPTH - 3363m CAST DEPTH - 3430dbar SURFACE BUCKET FOR O2 AND SALINITY ONLY KOJI/NAOAKI
33	LS30 - CTD CAST ONLY
34	LS31 - 75 13.91N 131 41.364W 0014 29AUG/03 WATER DEPTH - 2580m CAST DEPTH - 2565dbar
35	LS32 - 75 4.456N 131.520W 0587 29AUG/03 WATER DEPTH - 3380m CAST DEPTH - 3470dbar
36	LS33 - FAILED CTD - DO CAST 33 ON SOUTHERN LEG
39	LS34 - 75 3.800N 145 3.712W 0943 30 AUG/03 WATER DEPTH - 3700m CAST DEPTH - 3748dbar SURFACE TEMP -1.3C
40,41	LS35 -CAST 1 - 76 3.800N 139 49.573W 0245 31AUG/03 WATER DEPTH - 3620m CAST DEPTH - 800dbar - no Cs@ 400m CAST 2 - 76 725N 139 48.800W 0409 31AUG/03 VWATER DEPTH - 3620m CAST DEPTH - 3662dbar
42,43	LS33 - CAST 1 - 75 0.080N 140 0.461W 0248 02SEPT/03 WATER DEPTH - 3585m CAST DEPTH - 800dbar CAST 2 - 74 59.798N 139 59.378W 0404 02SEPT/03 WATER DEPTH - 3580m CAST DEPTH - 3687dbar SURFACE TEMP - -1.4C
44	LS36 - 74 14.821N 138 30.894W 133402SEPT/03 WATER DEPTH - 3400m CAST DEPTH - 1600dbar O2 CALIBRATION
45	LS37 73 29.910N 136 54.800W 2055 SEPT2/03 WATER DEPTH - 3128m CAST DEPTH - 3184dbar chla - CALIBRATION CURVE @75m (N6l) - USING Celine's filters included blank in data set.
46	LS38 - 72 39.965N 136 9.954W 0450 03SEPT/03 WATER DEPTH - 2585 CAST DEPTH - 1600dbar - O2 CALIBRATION HCH SAMPLES

Table 8. List of cast number and depth where interpolation of CTD data was required.

Cast	Start (db)	End (db)	Interval (db)	Property
1	1	3	2	Temperature and Conductivity
2	2	7	4	Temperature and Conductivity
2	7	11	3	Temperature and Conductivity
3	1	3	2	Temperature and Conductivity
3	95	97	1	Temperature and Conductivity
4	1	3	2	Temperature and Conductivity
4	9	12	2	Temperature and Conductivity
4	19	21	1	Temperature and Conductivity
5	1	3	2	Temperature and Conductivity
5	1542	1544	1	Temperature and Conductivity
6	1	2	1	Temperature and Conductivity
6	10	15	4	Temperature and Conductivity
7	1	3	2	Temperature and Conductivity
8	1	4	3	Temperature and Conductivity
9	1	2	1	Temperature and Conductivity
10	1	2	1	Temperature and Conductivity
10	5	12	6	Temperature and Conductivity
10	18	21	2	Temperature and Conductivity
10	259	261	1	Temperature and Conductivity
11	1	4	3	Temperature and Conductivity
11	7	14	6	Temperature and Conductivity
11	273	275	1	Temperature and Conductivity
12	1	4	3	Temperature and Conductivity
12	7	11	3	Temperature and Conductivity
12	19	21	1	Temperature and Conductivity
13	1	2	1	Temperature and Conductivity
14	1	3	2	Temperature and Conductivity
14	4	6	1	Temperature and Conductivity
14	7	12	4	Temperature and Conductivity
14	12	15	2	Temperature and Conductivity
14	15	18	2	Temperature and Conductivity
14	18	24	5	Temperature and Conductivity
14	247	250	2	Temperature and Conductivity
15	1	3	2	Temperature and Conductivity
16	1	3	2	Temperature and Conductivity
16	12	15	2	Temperature and Conductivity
16	17	19	1	Temperature and Conductivity
17	1	4	3	Temperature and Conductivity
17	25	27	1	Temperature and Conductivity
18	1	2	1	Temperature and Conductivity
18	7	10	2	Temperature and Conductivity

Cast	Start (db)	End (db)	Interval (db)	Property
18	10	13	2	Temperature and Conductivity
18	622	625	2	Temperature and Conductivity
19	1	3	2	Temperature and Conductivity
19	11	16	4	Temperature and Conductivity
20	1	14	13	Temperature and Conductivity
20	25	27	1	Temperature and Conductivity
21	1	3	2	Temperature and Conductivity
23	1	3	2	Temperature and Conductivity
24	1	3	2	Temperature and Conductivity
24	327	329	1	Temperature and Conductivity
25	1	3	2	Temperature and Conductivity
26	1	5	4	Temperature and Conductivity
26	14	17	2	Temperature and Conductivity
26	456	459	2	Temperature and Conductivity
27	1	3	2	Temperature and Conductivity
28	1	7	6	Temperature and Conductivity
29	1	5	4	Temperature and Conductivity
29	8	10	1	Temperature and Conductivity
29	17	22	4	Temperature and Conductivity
30	1	3	2	Temperature and Conductivity
31	1	6	5	Temperature and Conductivity
31	22	24	1	Temperature and Conductivity
31	26	28	1	Temperature and Conductivity
32	1	6	5	Temperature and Conductivity
33	1	3	2	Temperature and Conductivity
34	1	5	4	Temperature and Conductivity
35	1	6	5	Temperature and Conductivity
36	9	11	1	Temperature and Conductivity
36	183	185	1	Temperature and Conductivity
37	1	16	15	Temperature and Conductivity
37	26	29	2	Temperature and Conductivity
38	1	4	3	Temperature and Conductivity
38	9	11	1	Temperature and Conductivity
39	1	5	4	Temperature and Conductivity
39	20	30	9	Temperature and Conductivity
39	336	341	4	Temperature and Conductivity
40	1	3	2	Temperature and Conductivity
40	7	9	1	Temperature and Conductivity
40	15	18	2	Temperature and Conductivity
41	1	3	2	Temperature and Conductivity
41	272	274	1	Temperature and Conductivity
42	1	2	1	Temperature and Conductivity
42	8	10	1	Temperature and Conductivity
42	12	15	2	Temperature and Conductivity

Cast	Start (db)	End (db)	Interval (db)	Property
43	1	5	4	Temperature and Conductivity
44	1	4	3	Temperature and Conductivity
45	1	3	2	Temperature and Conductivity
46	1	8	7	Temperature and Conductivity
46	9	12	2	Temperature and Conductivity
46	19	22	2	Temperature and Conductivity
47	1	5	4	Temperature and Conductivity

5. INDIVDUAL STATION PLOTS

The following section contains data plots for each CTD cast taken on the 2003-21 cruise. CTD and chemistry data are plotted in eight figures laid out over two pages per cast.

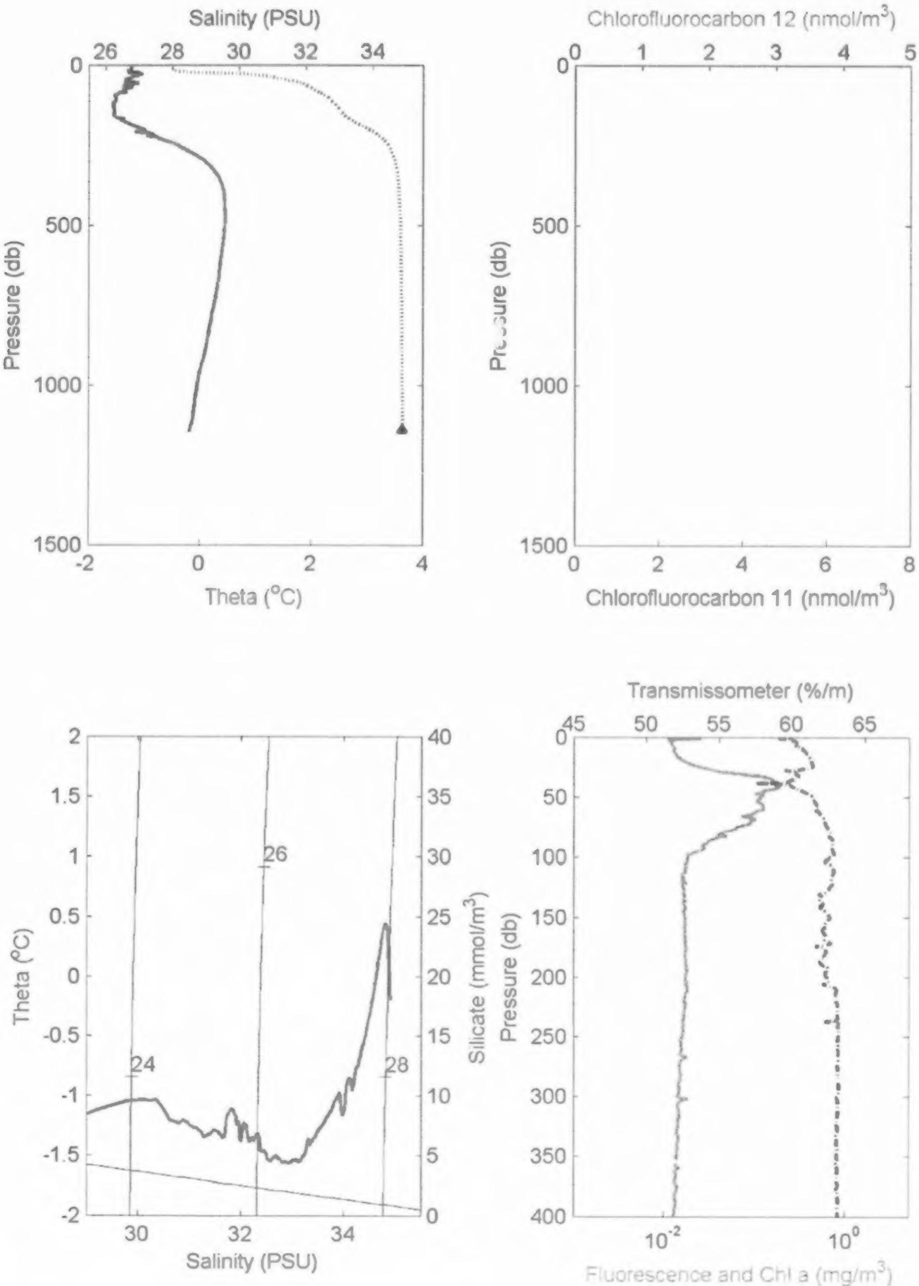
Property Legend:

	Salinity (PSU), CTD
▲	Salinity (PSU), Bottle
	Theta (°C)
◇	CFC 12 (nmol/m^3)
▶	CFC 11 (nmol/m^3)
◁	Silicate (mmol/m^3)
	Transmissometer (%/m)
	Fluorescence (mg/m^3)
●	Chlorophyll-a (mg/m^3)
◁	Phosphate (mmol/m^3)
▲	Nitrate (mmol/m^3)
○	Silicate (mmol/m^3)
	Oxygen (mL/L), Sensor
■	Oxygen (mL/L),
◁	DIC (µmol/kg)
▲	Alkalinity (µmol/kg)
◇	O^{18} (‰)
▶	Barium (µmol/m^3)

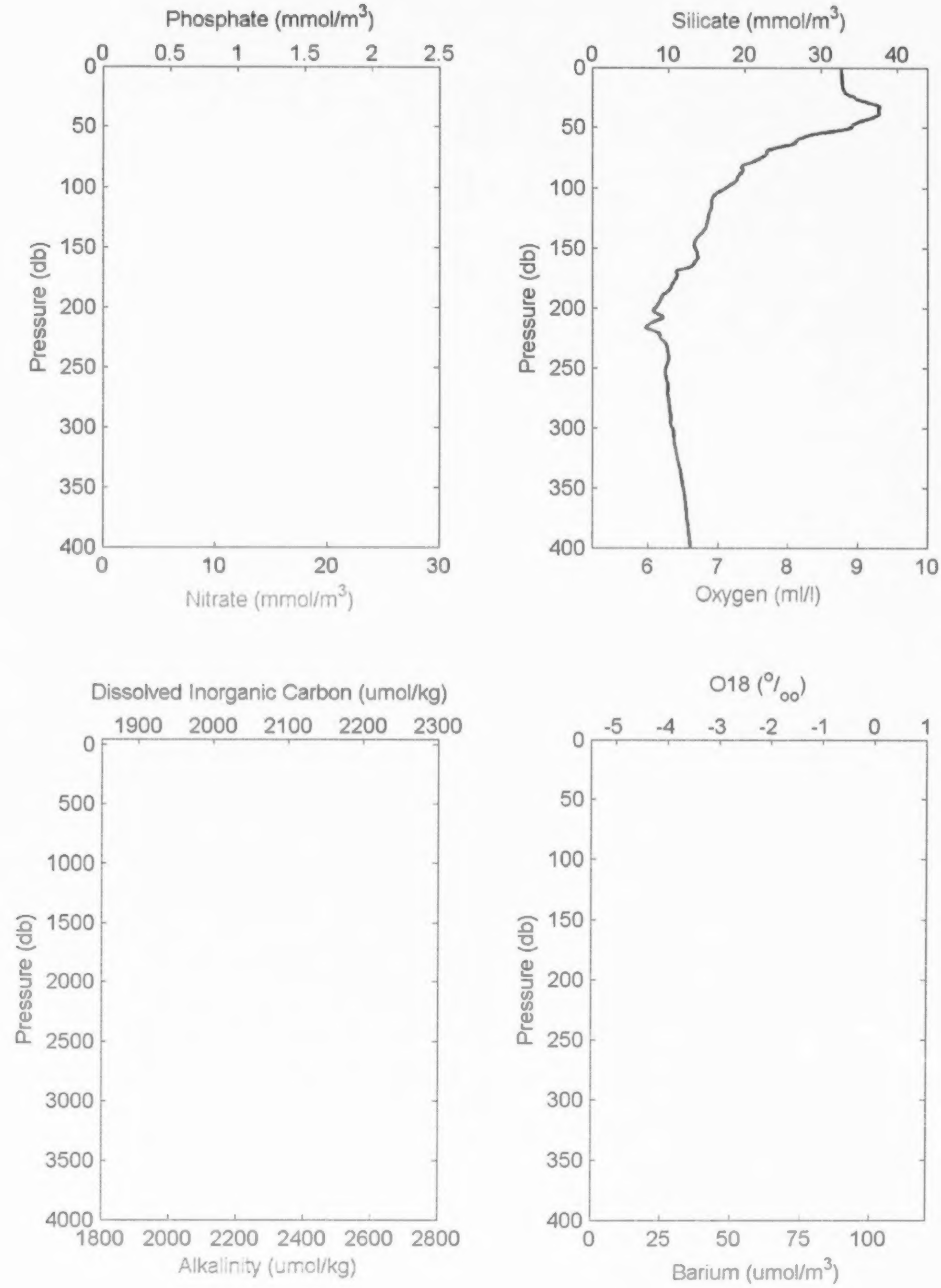
◁	Cesium (Bq/m^3)
●	Iodine-129 (10^7 atom/L)

▲	TOC (mmol/m^3)

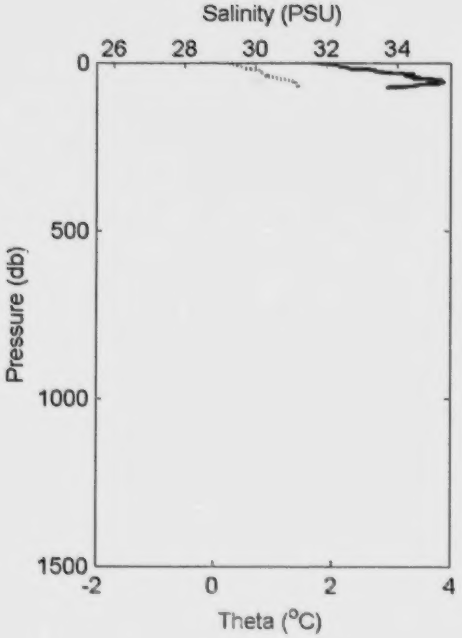
2003-21: Cast 1 Station LS01

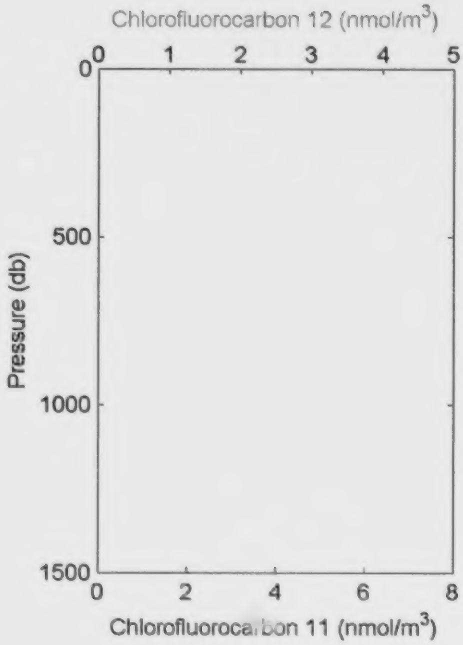


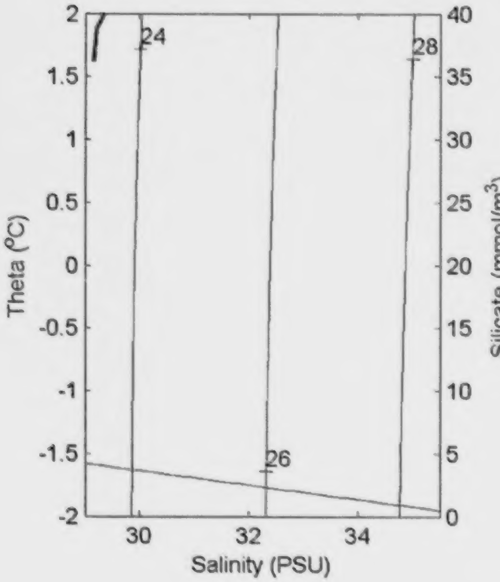
2003-21: Cast 1 Station LS01

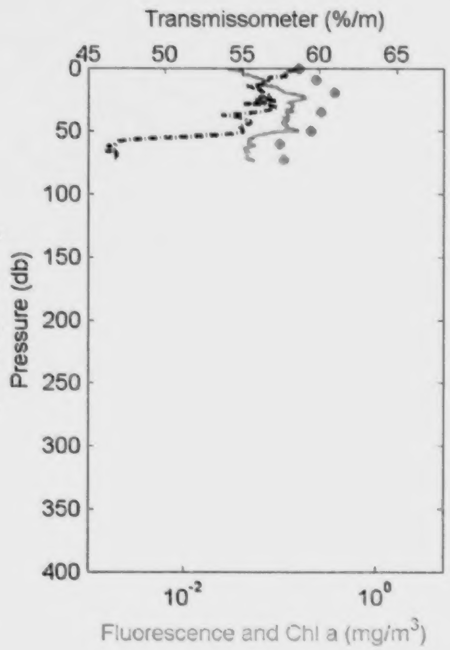


2003-21: Cast 2 Station LS02

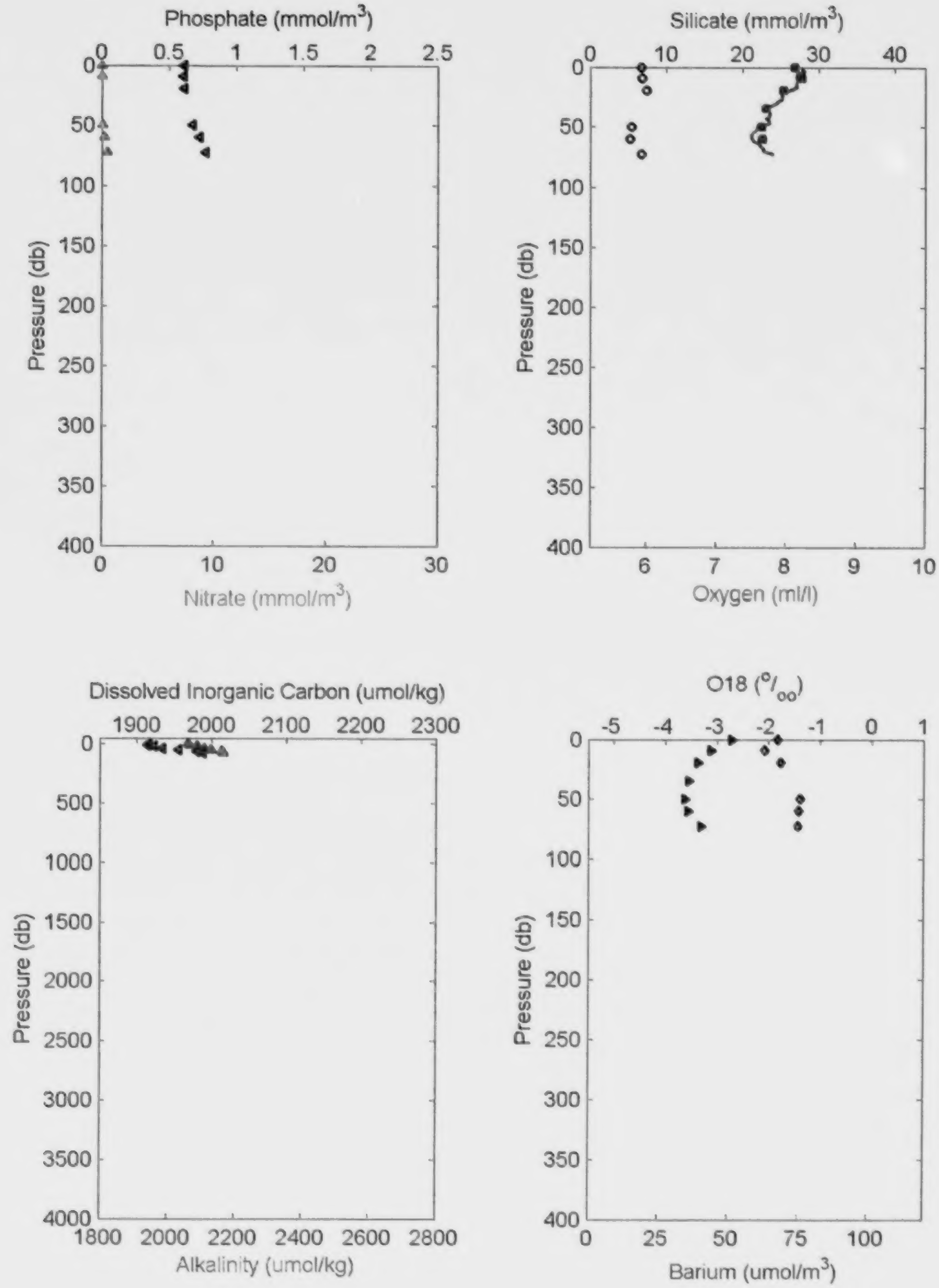




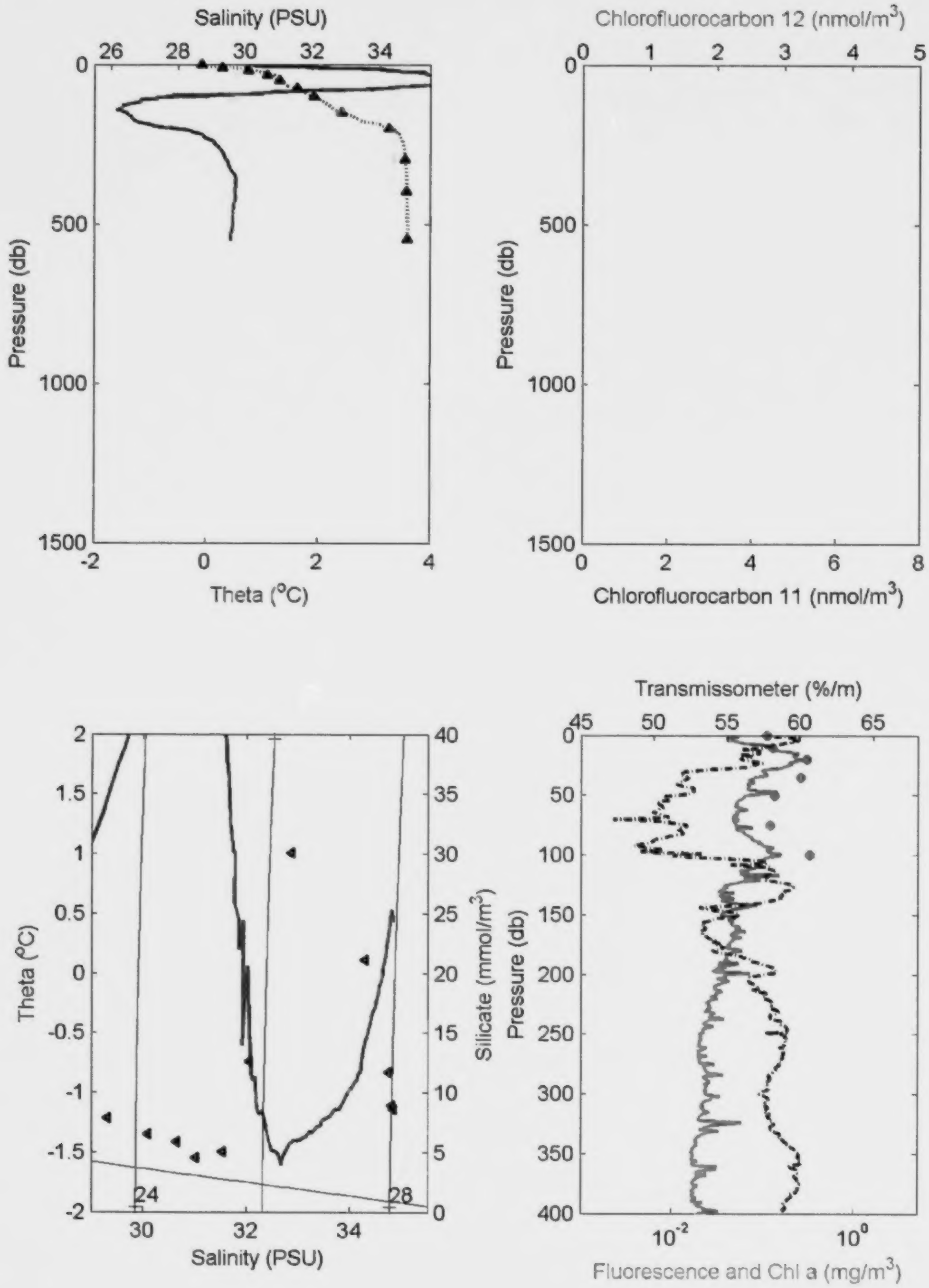




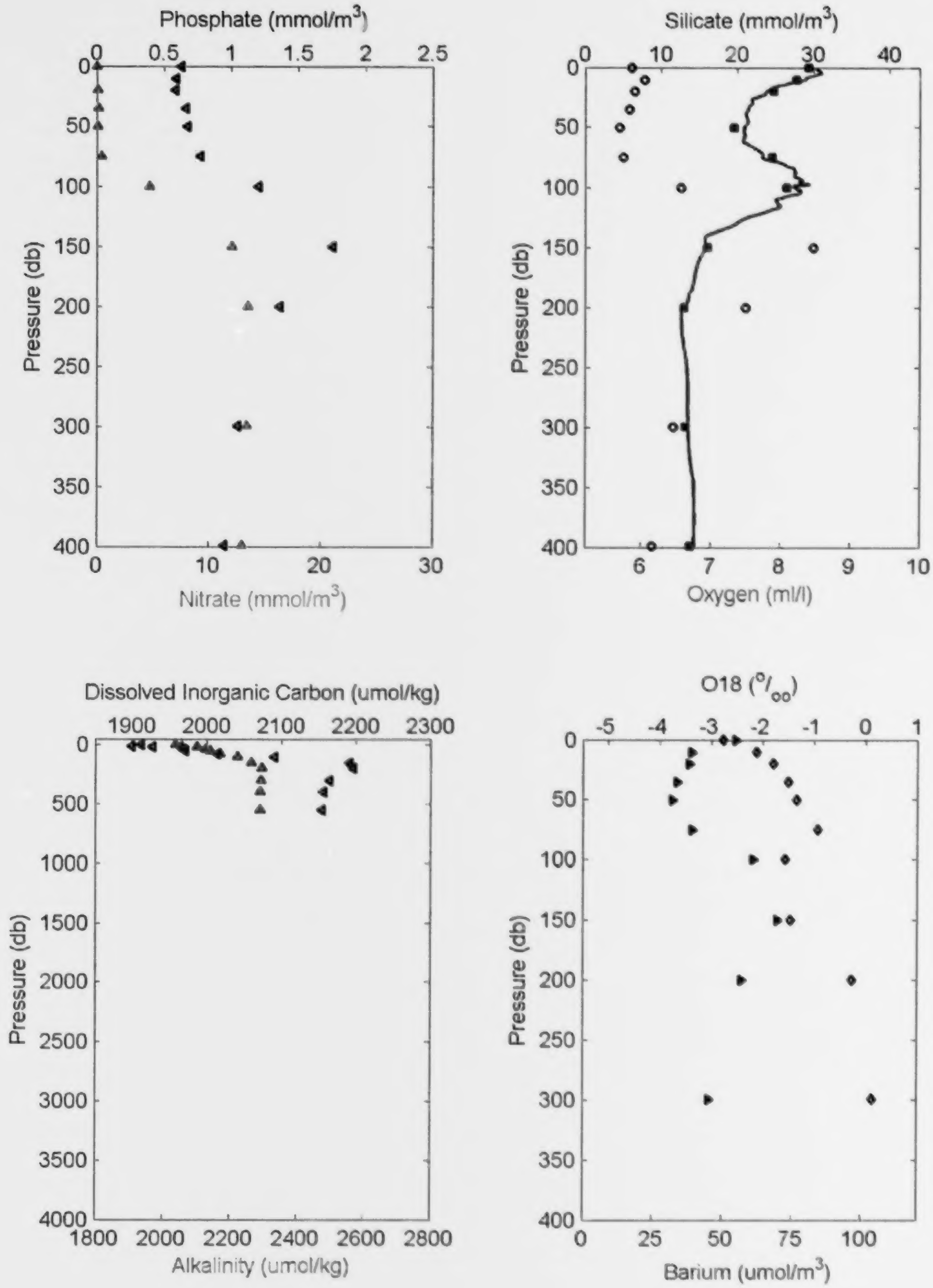
2003-21: Cast 2 Station LS02



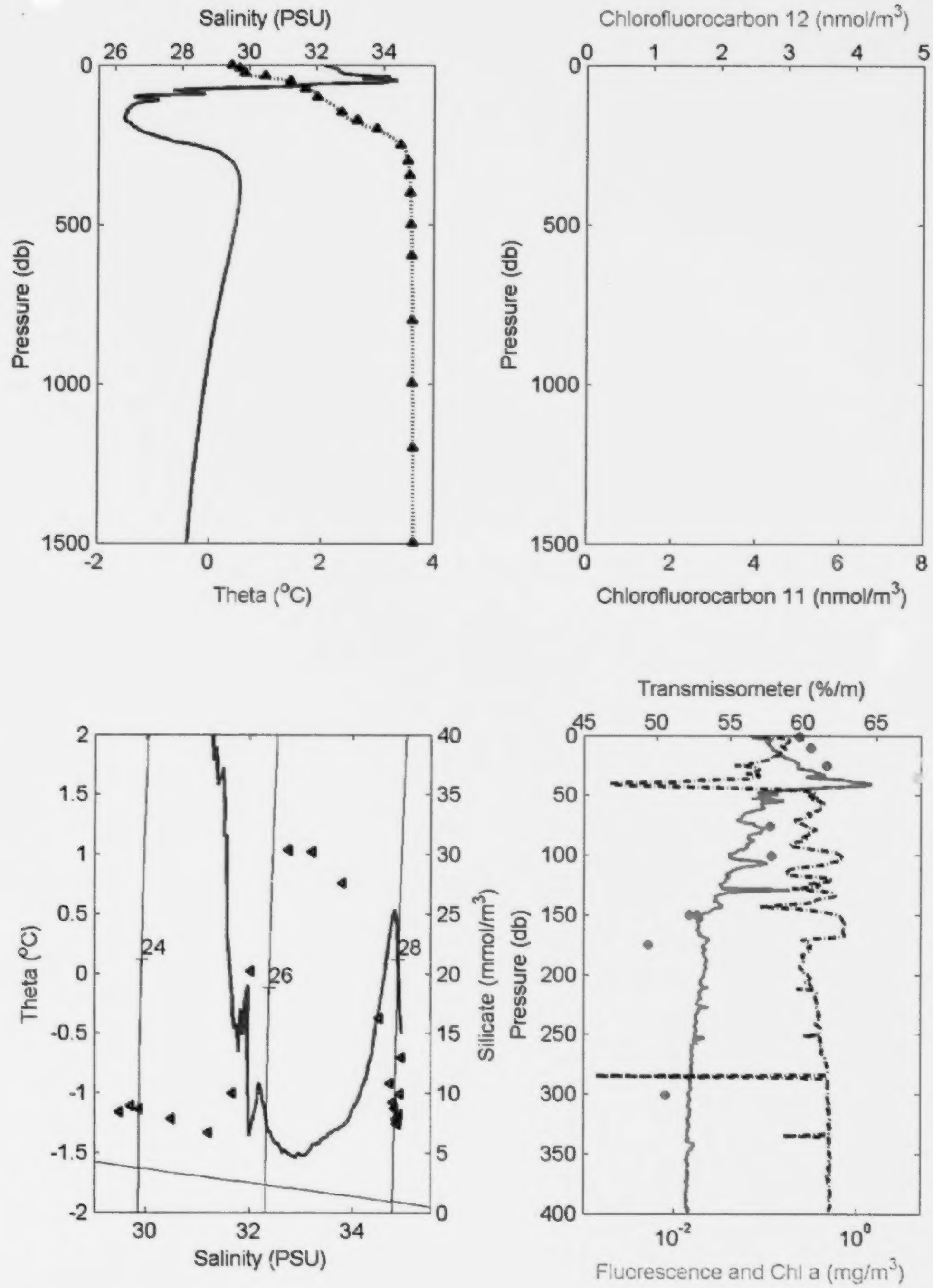
2003-21: Cast 3 Station LS03



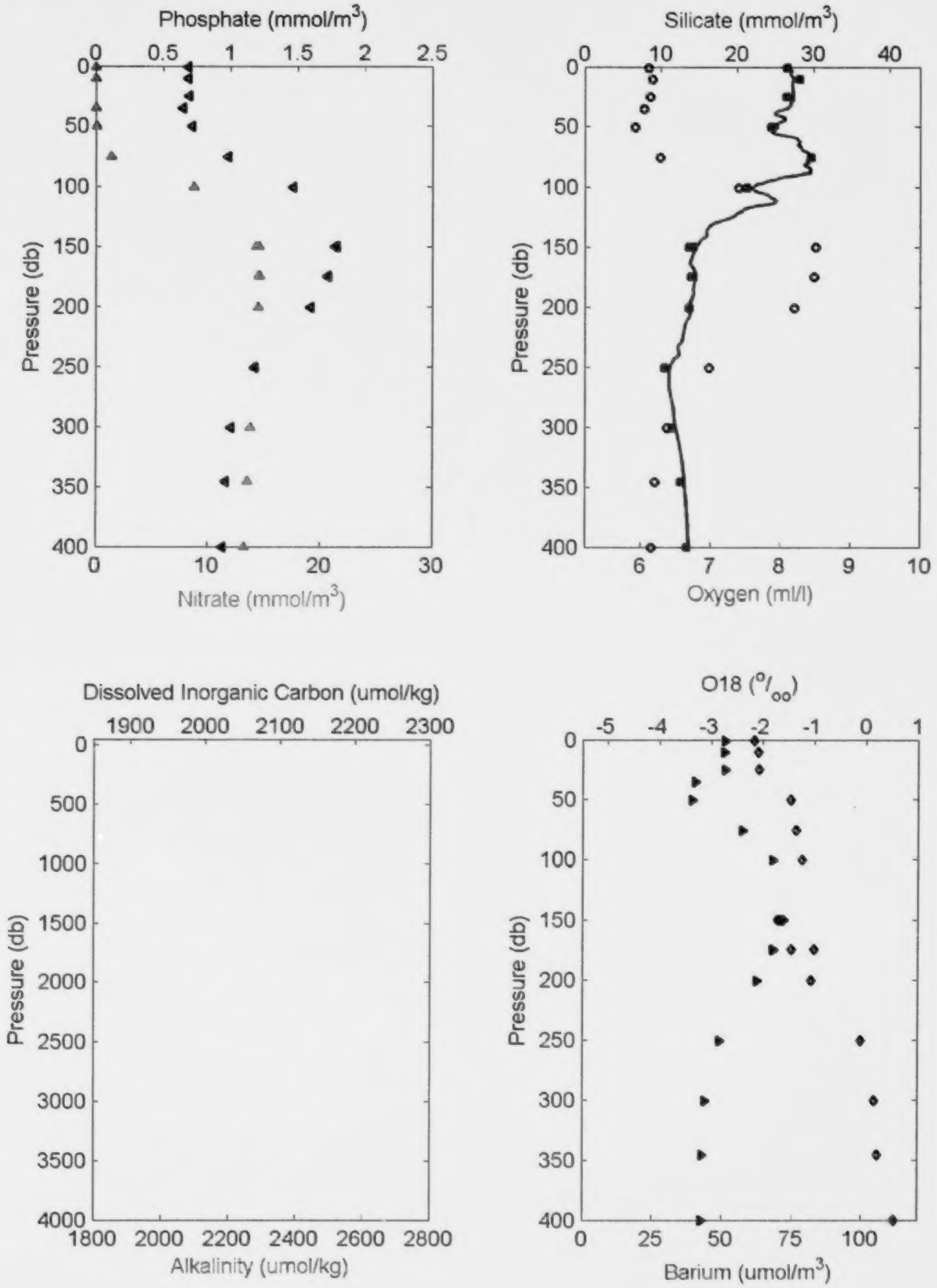
2003-21: Cast 3 Station LS03



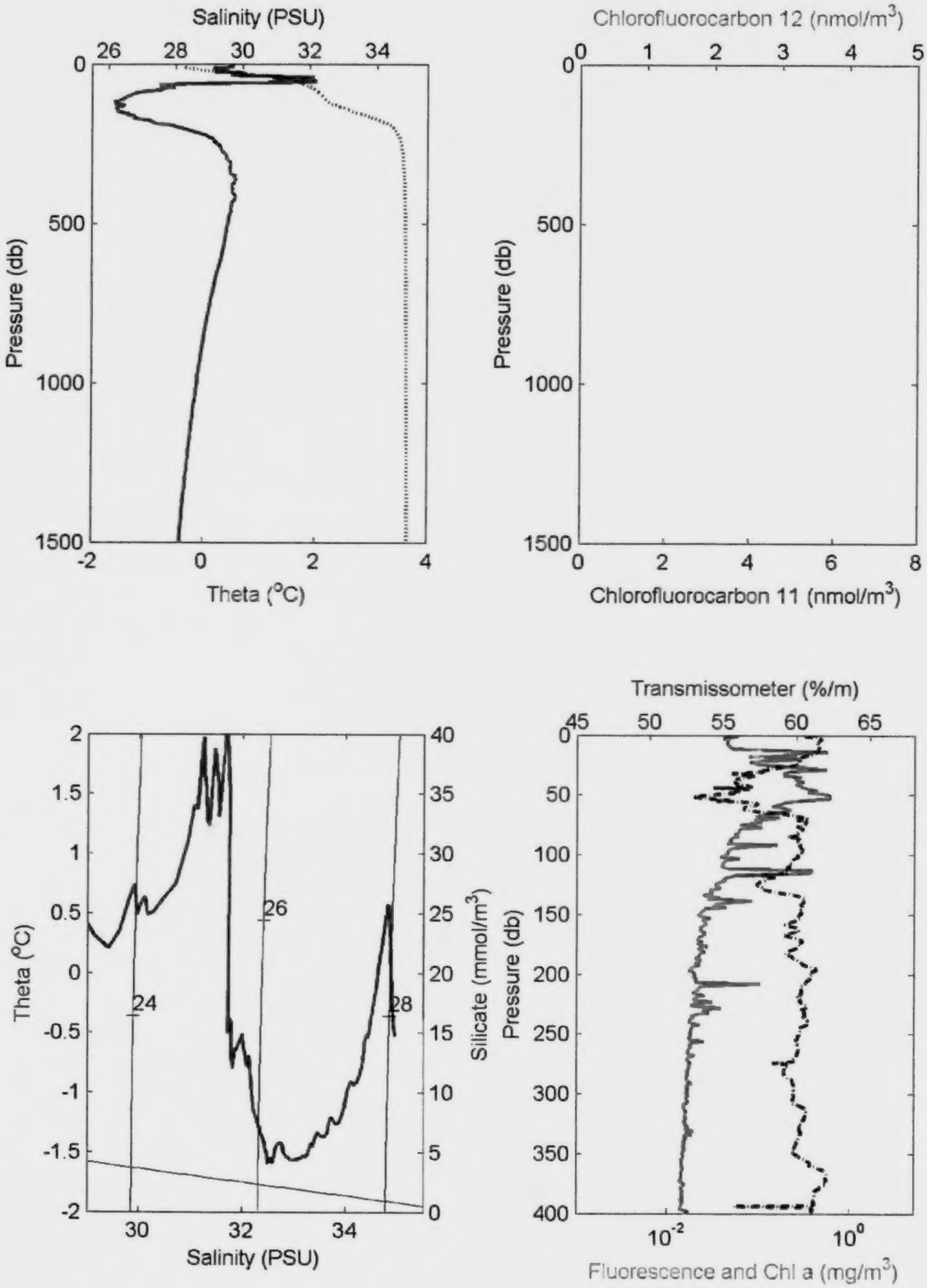
2003-21: Cast 4 Station LS04



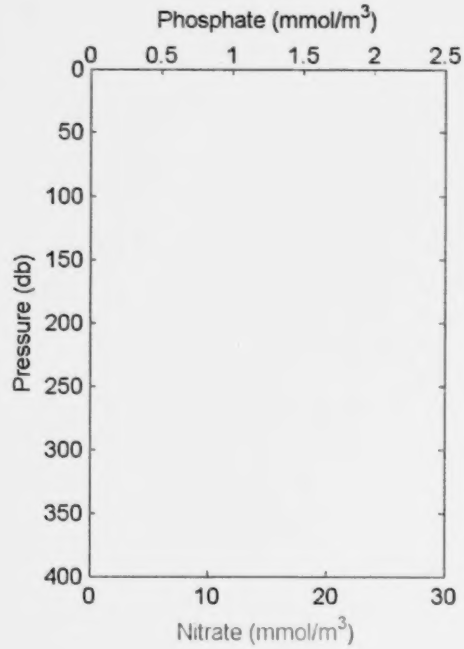
2003-21: Cast 4 Station LS04

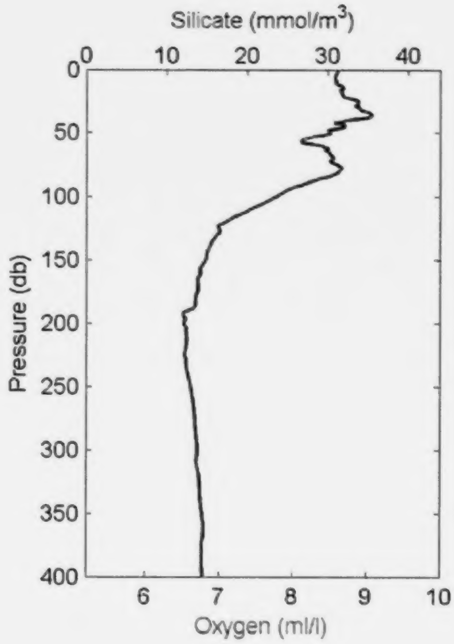


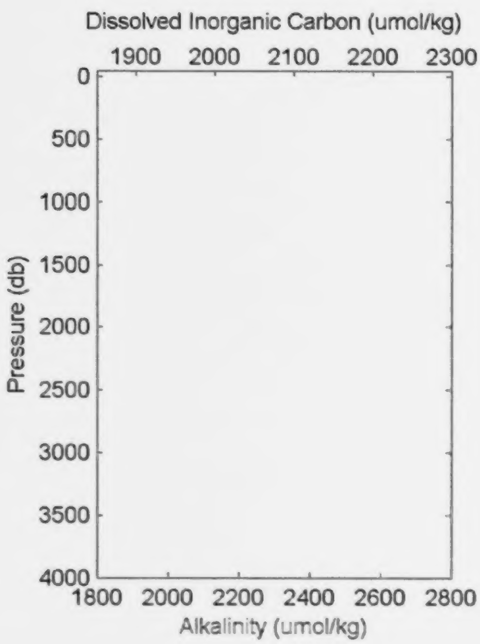
2003-21: Cast 5 Station LS05

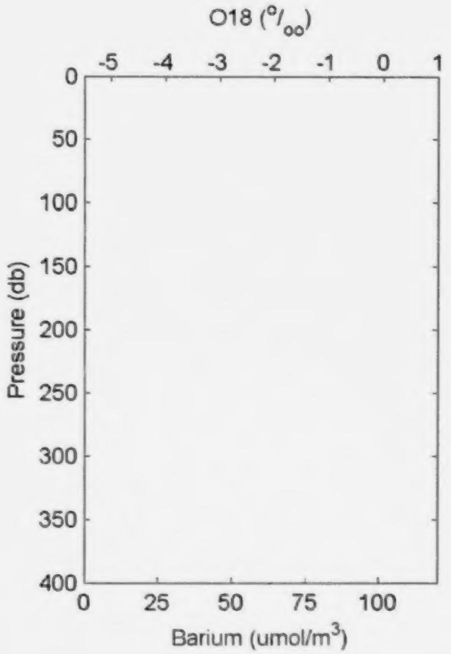


2003-21: Cast 5 Station LS05

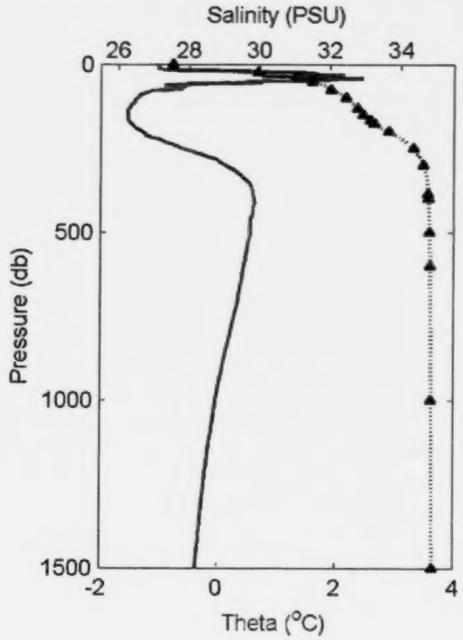


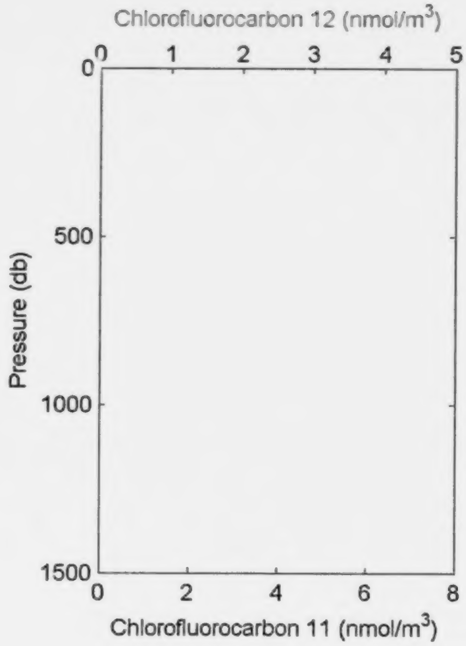


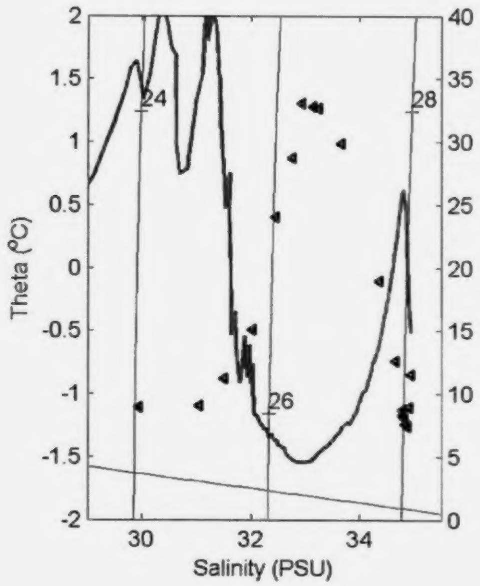


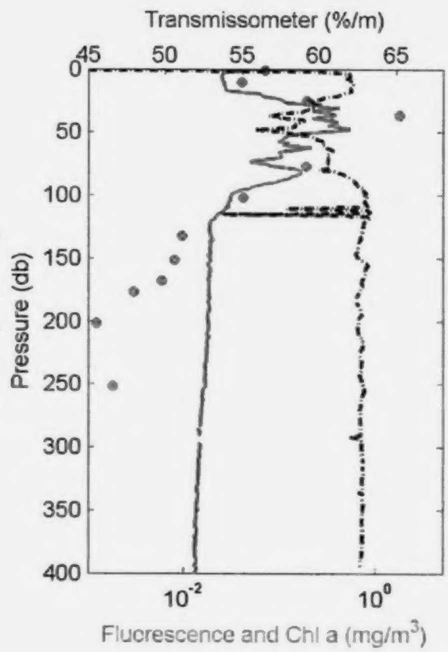


2003-21: Cast 6 Station LS06

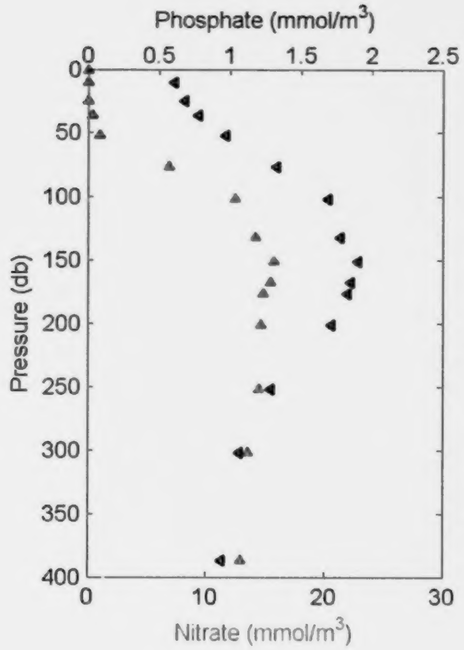


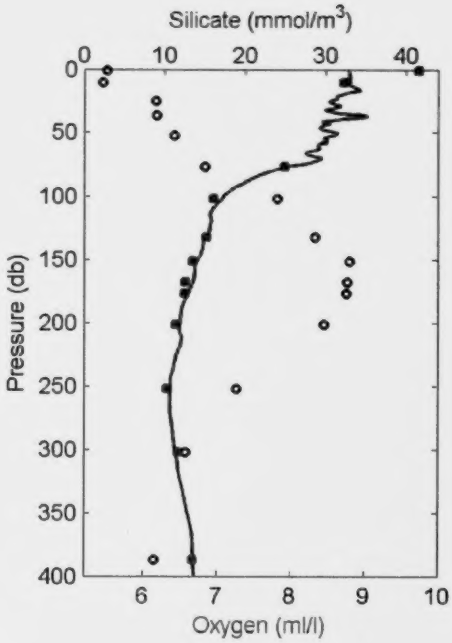


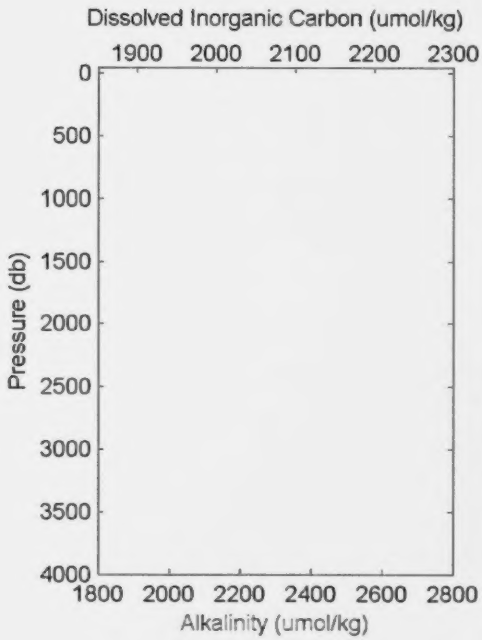


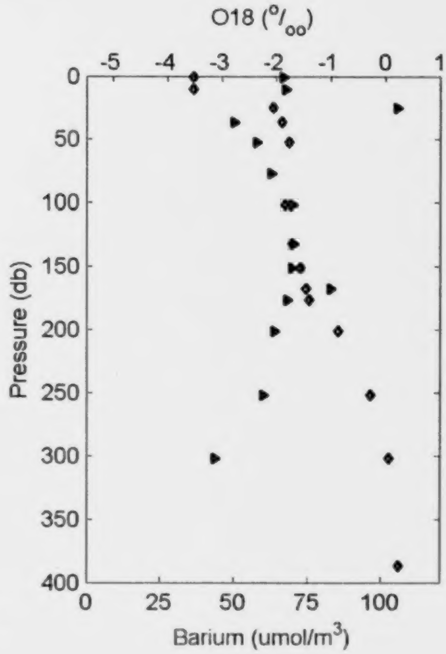


2003-21: Cast 6 Station LS06

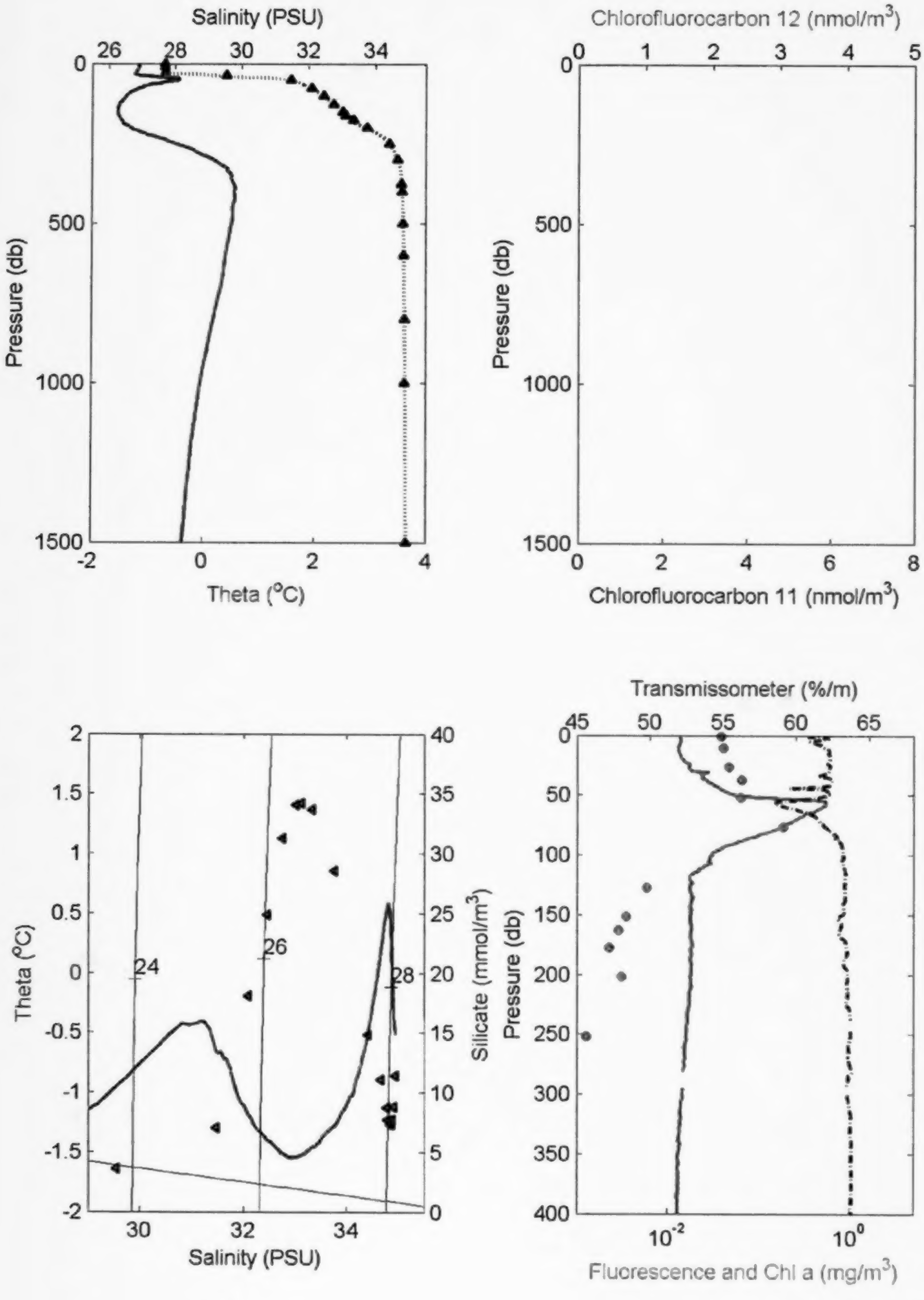




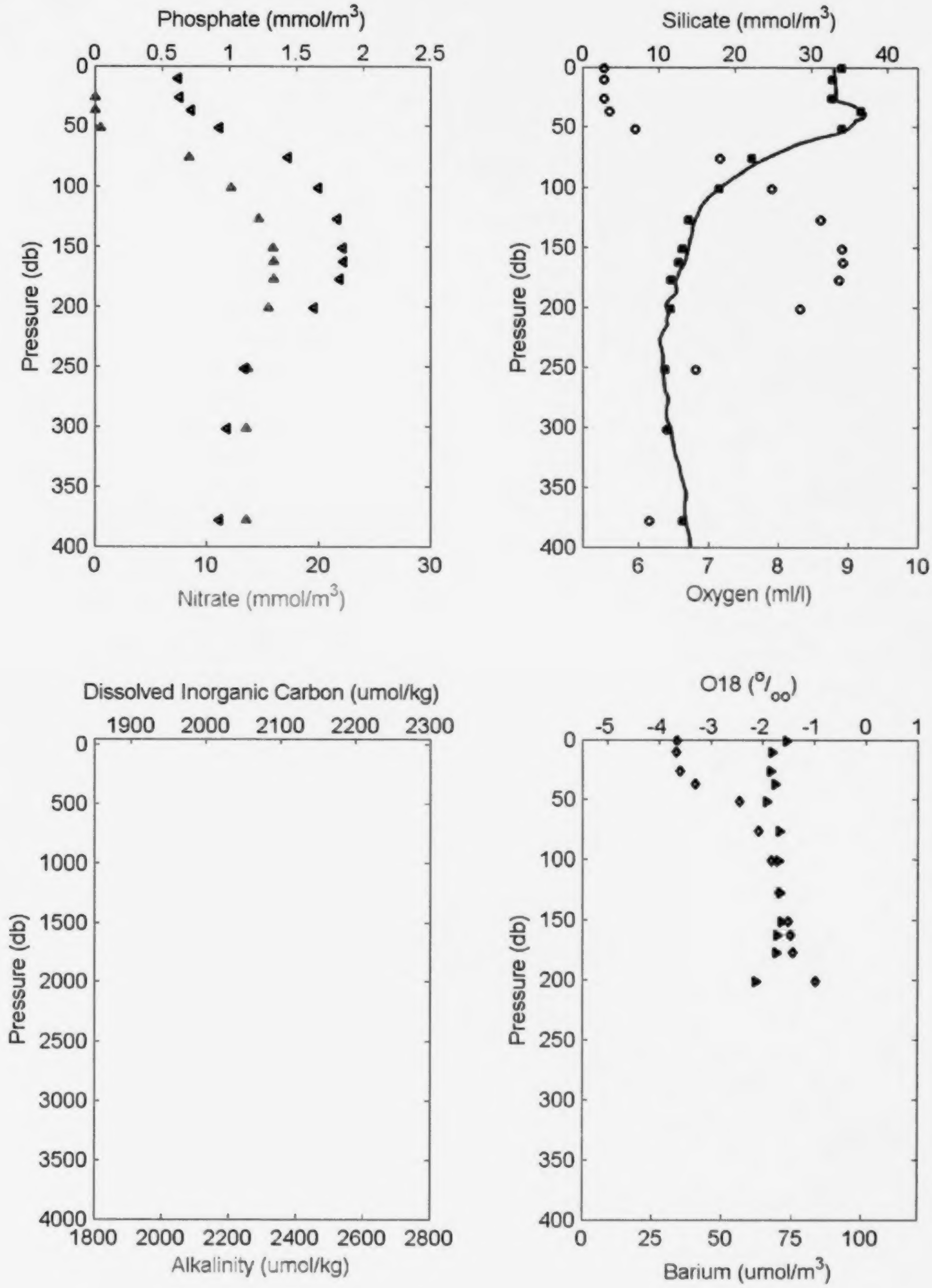




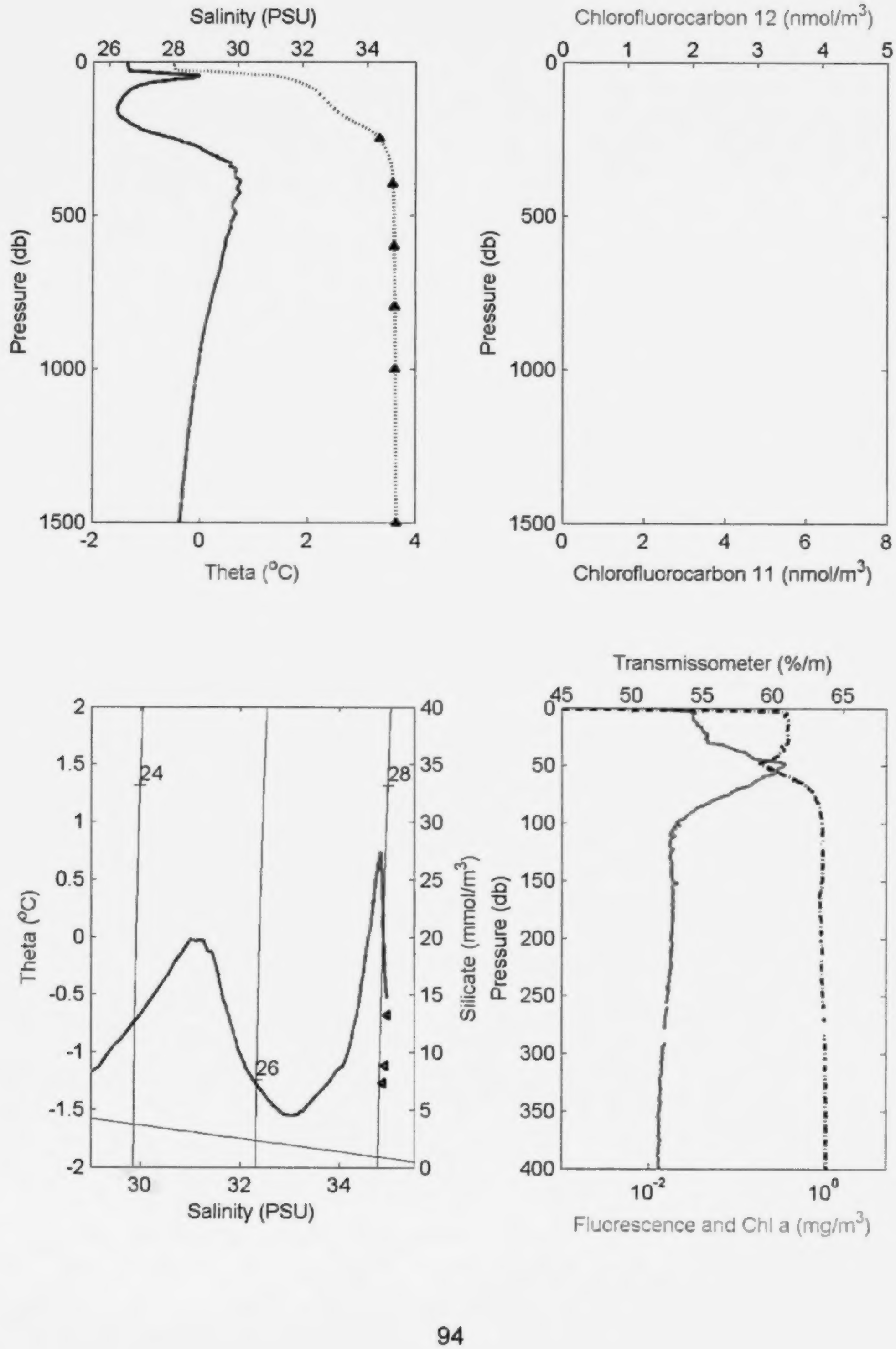
2003-21: Cast 7 Station LS07



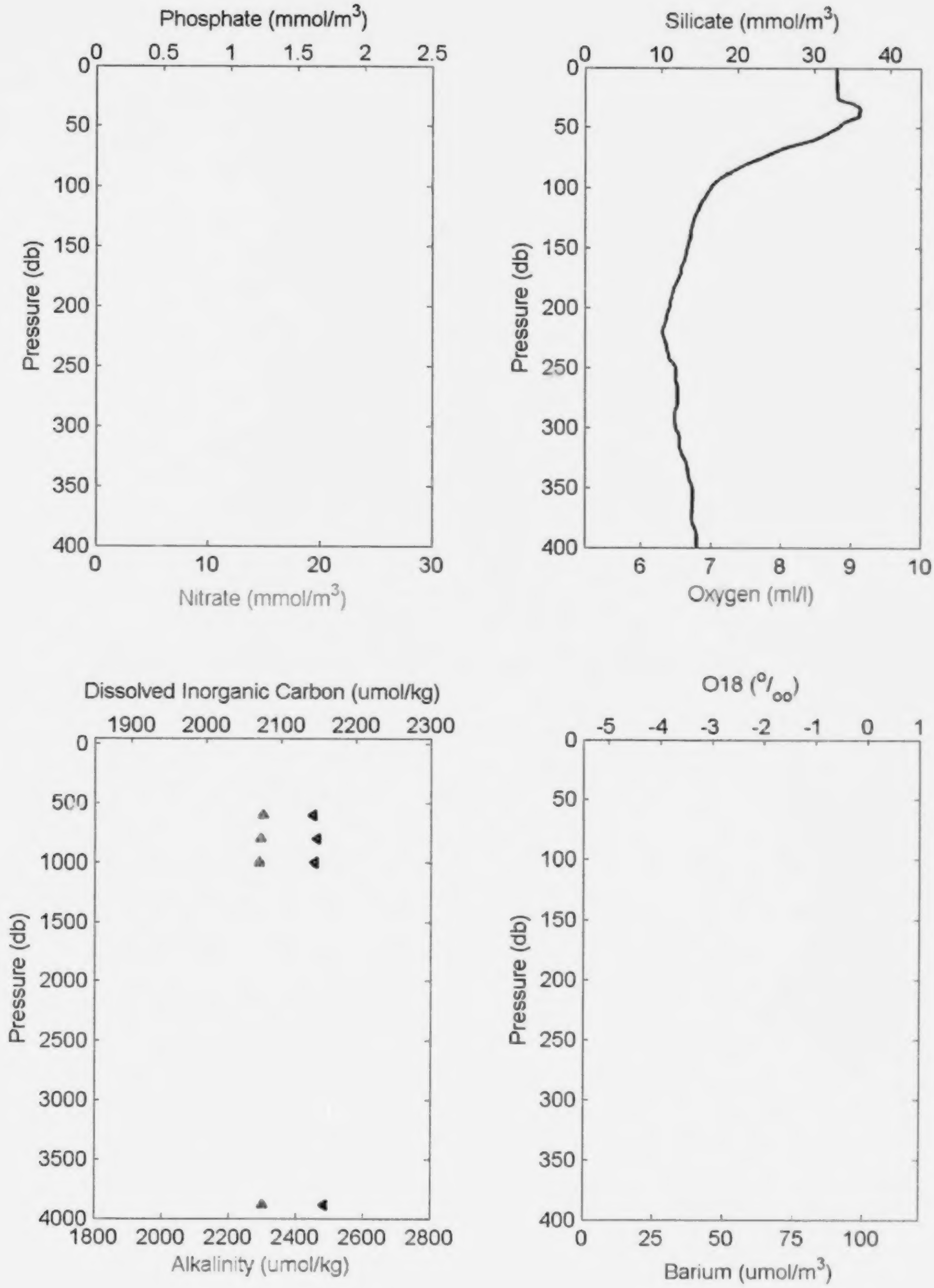
2003-21: Cast 7 Station LS07



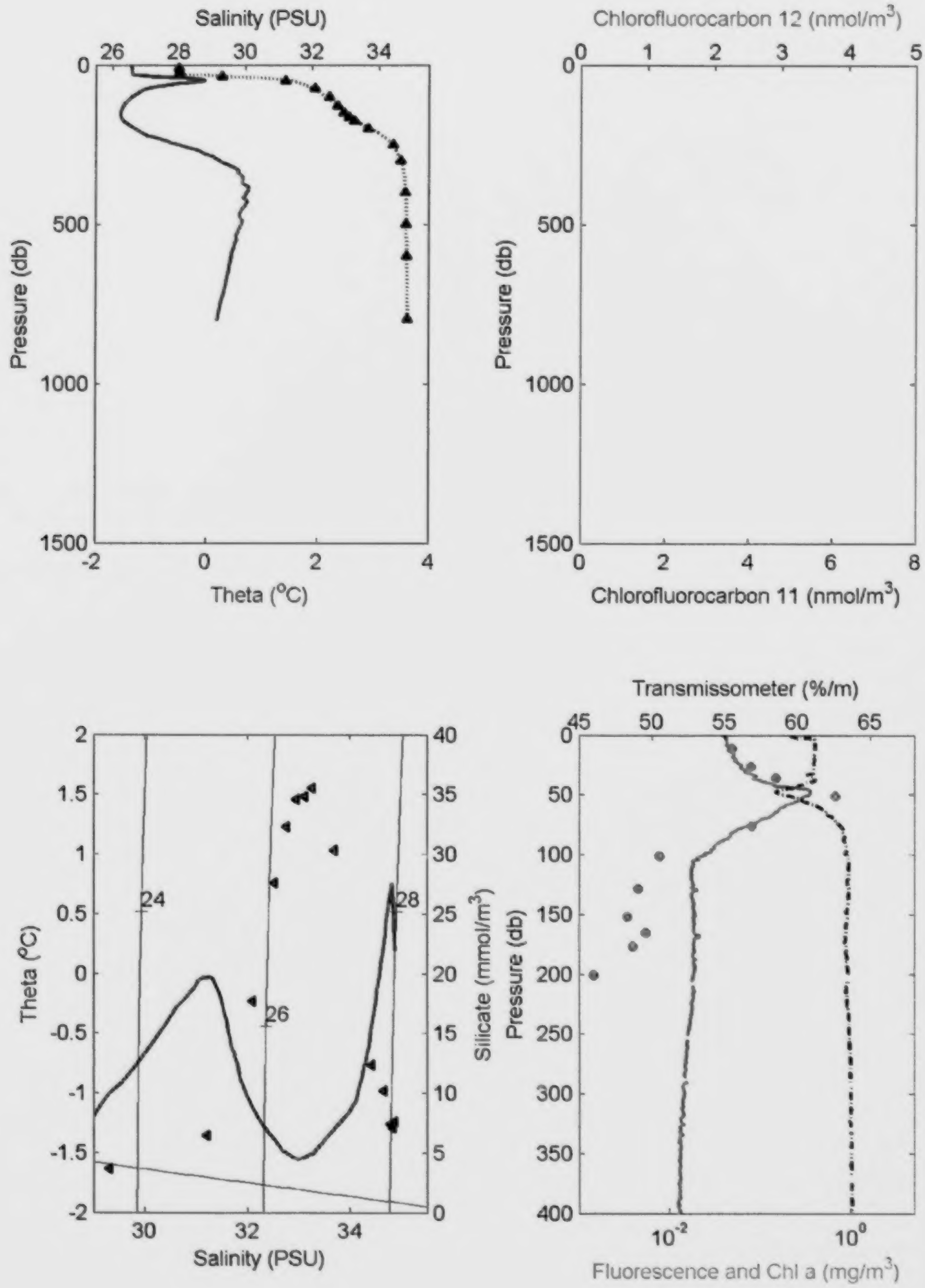
2003-21: Cast 8 Station LS08



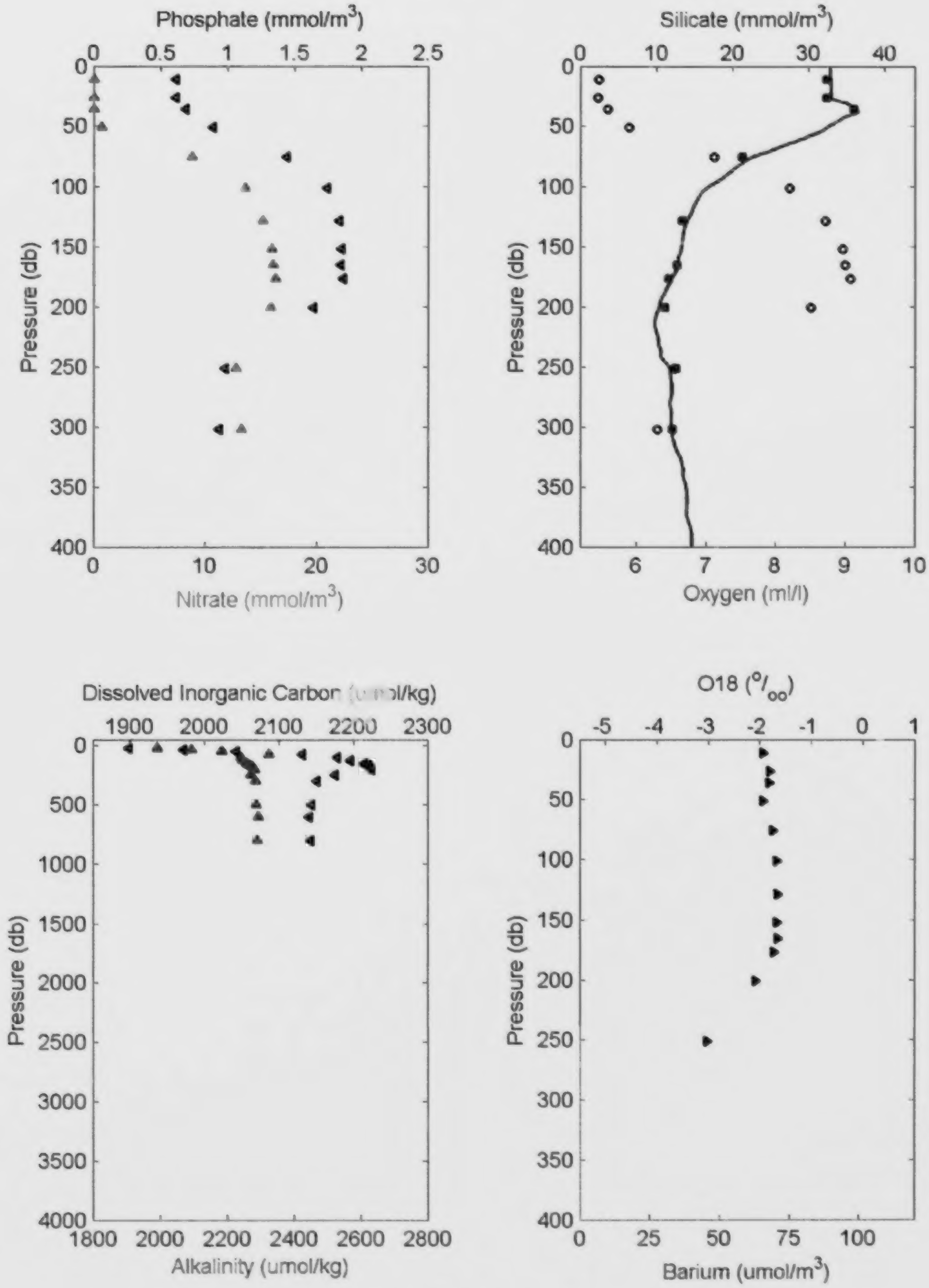
2003-21: Cast 8 Station LS08



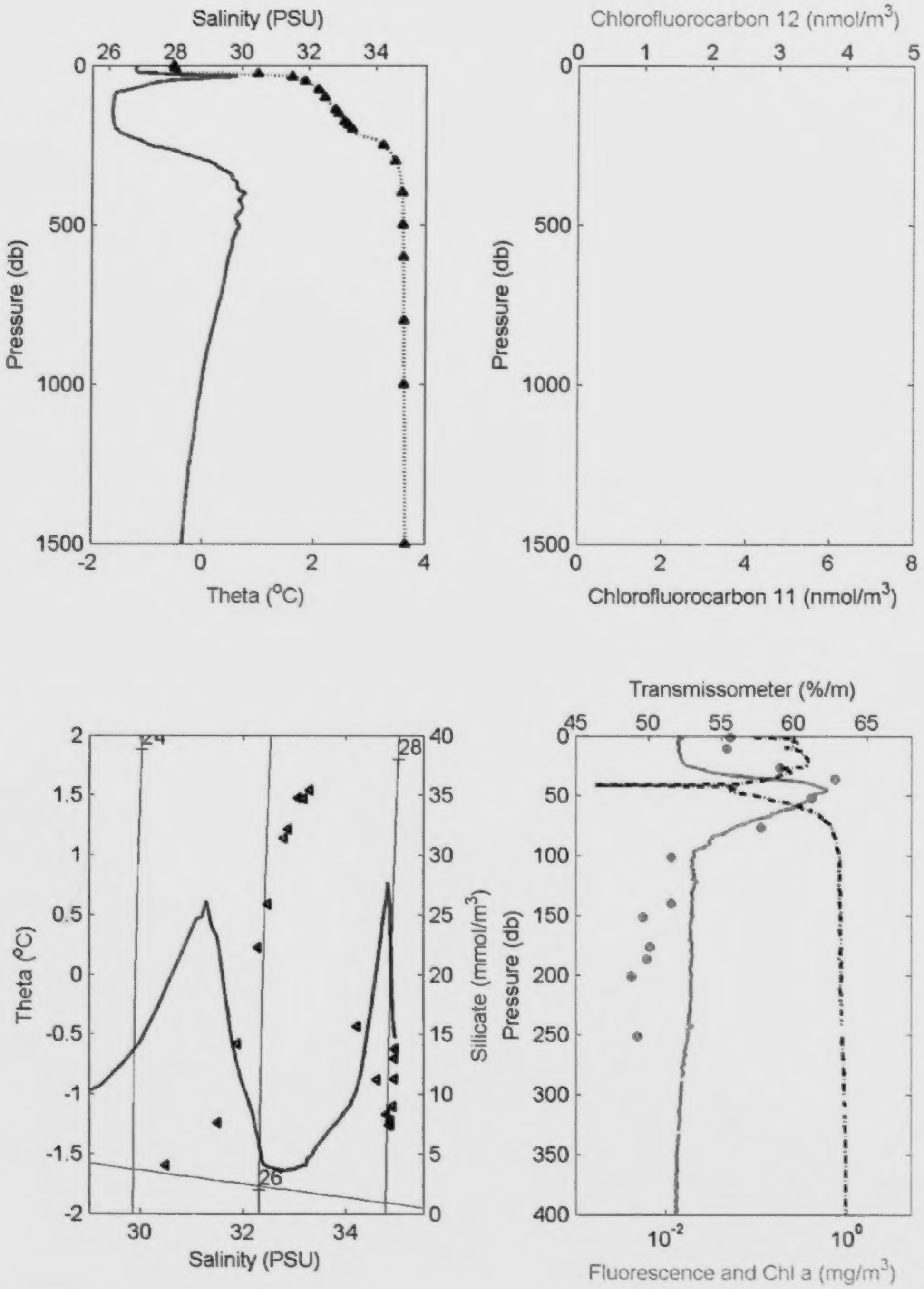
2003-21: Cast 9 Station LS08-2



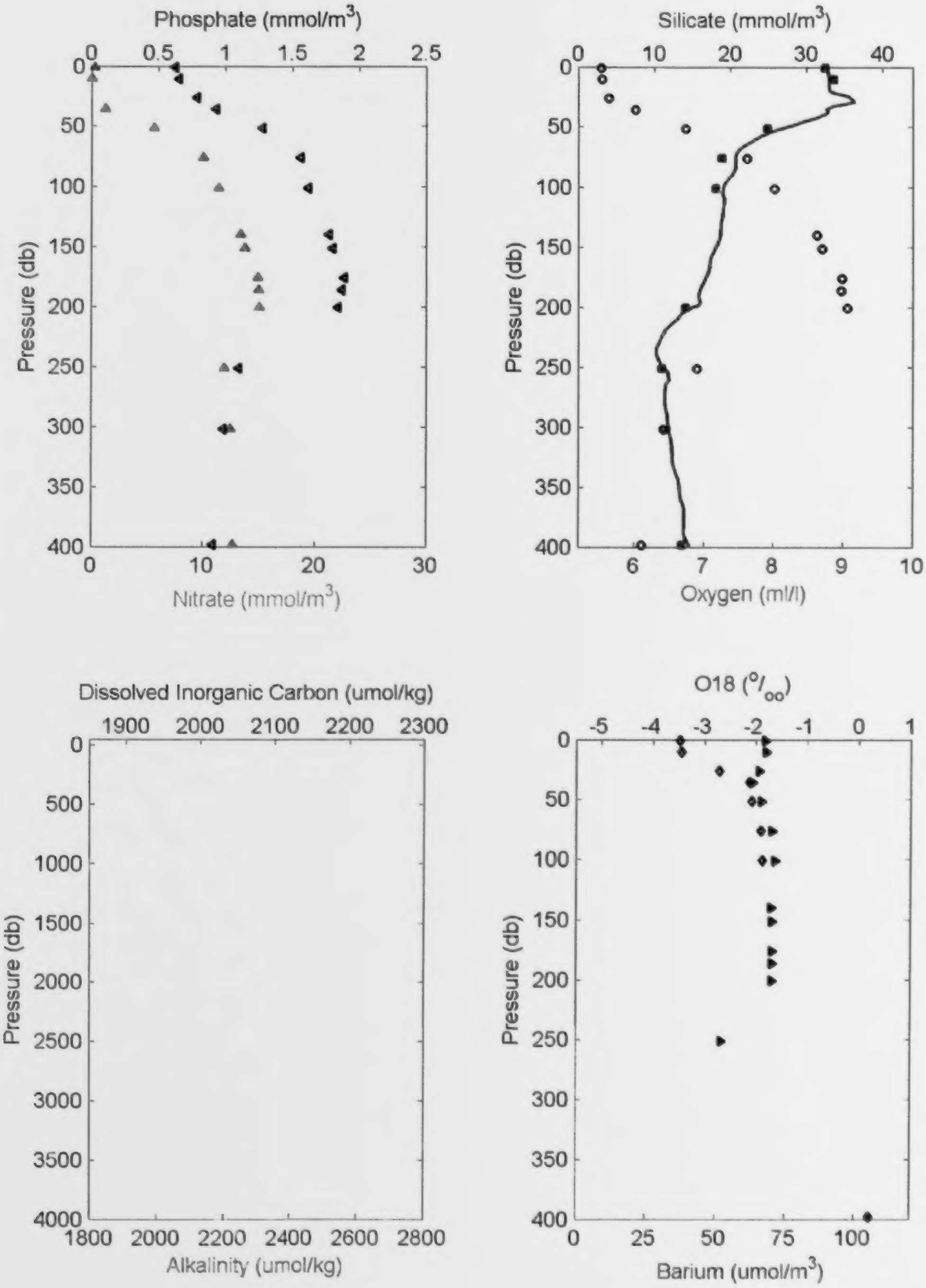
2003-21: Cast 9 Station LS08-2



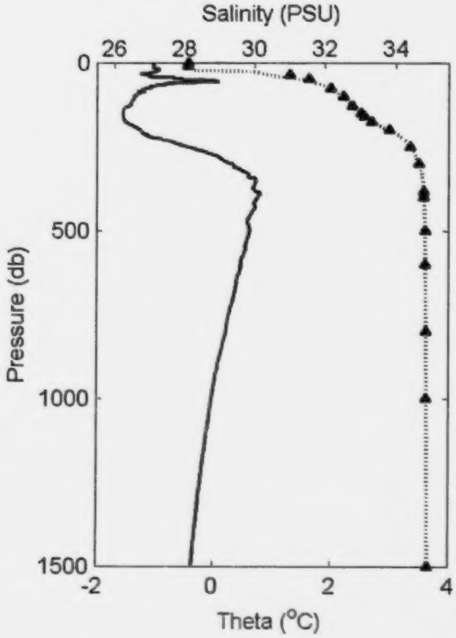
2003-21: Cast 10 Station LS09

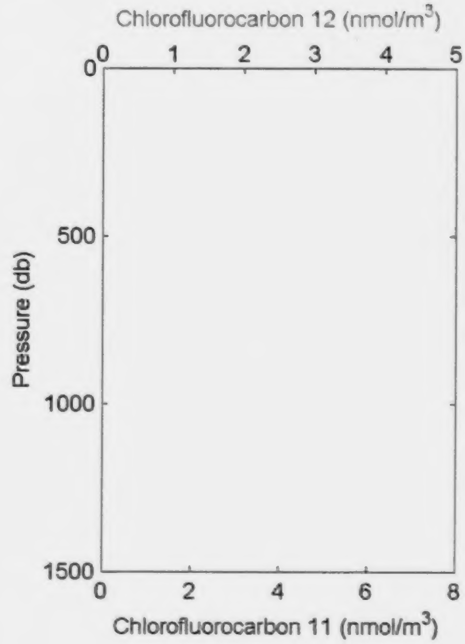


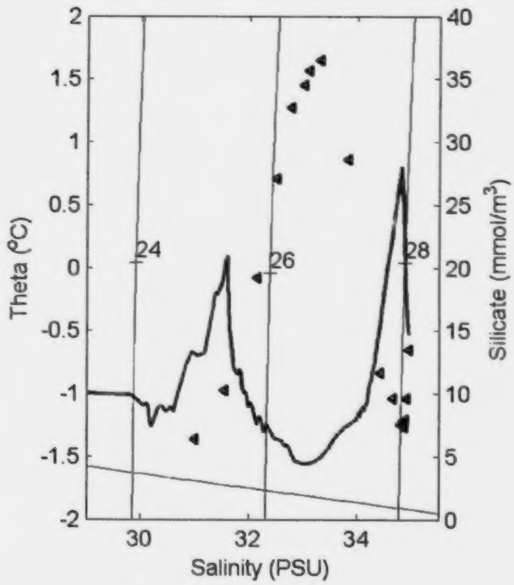
2003-21: Cast 10 Station LS09

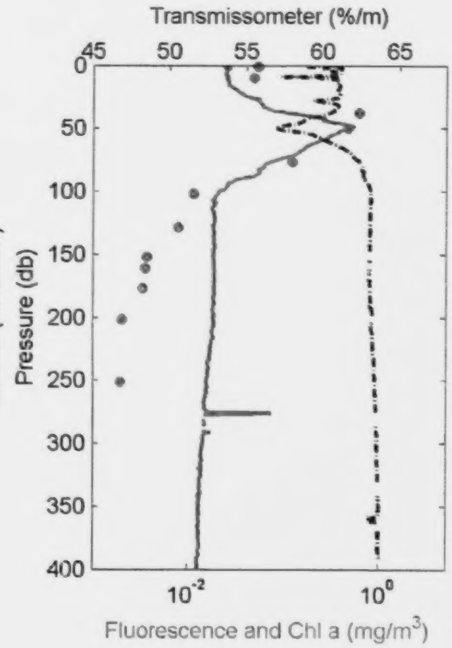


2003-21: Cast 11 Station LS10

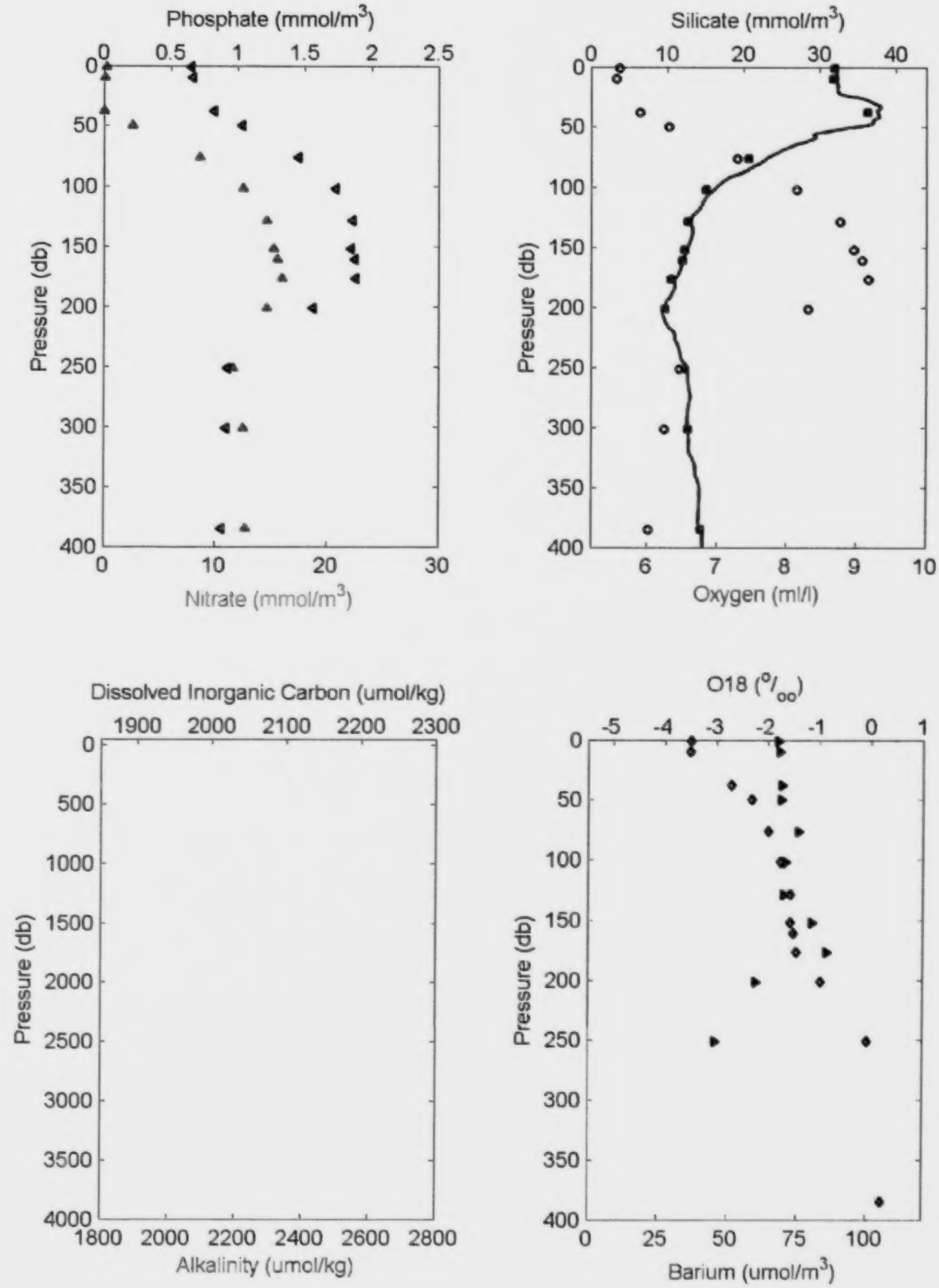




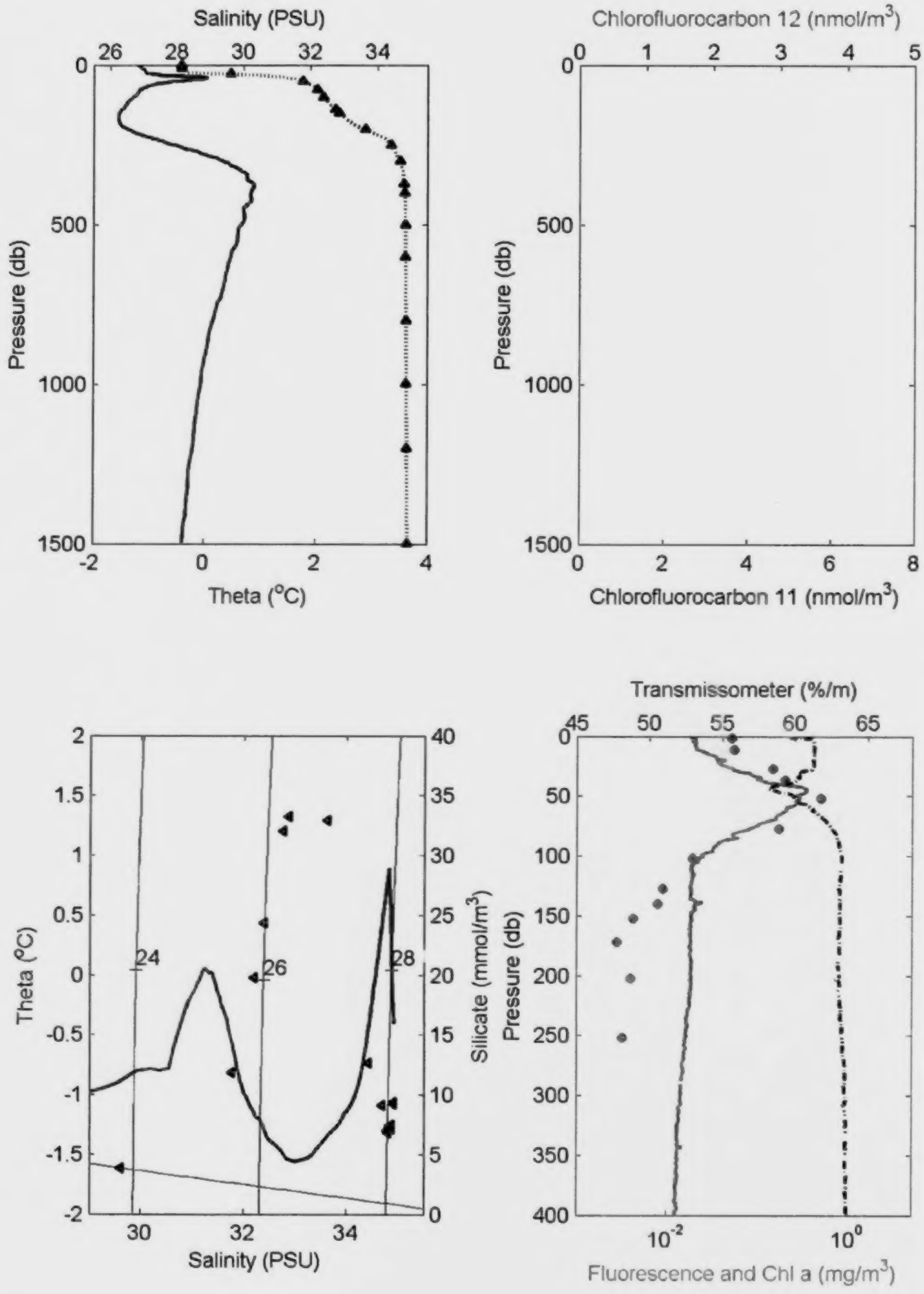




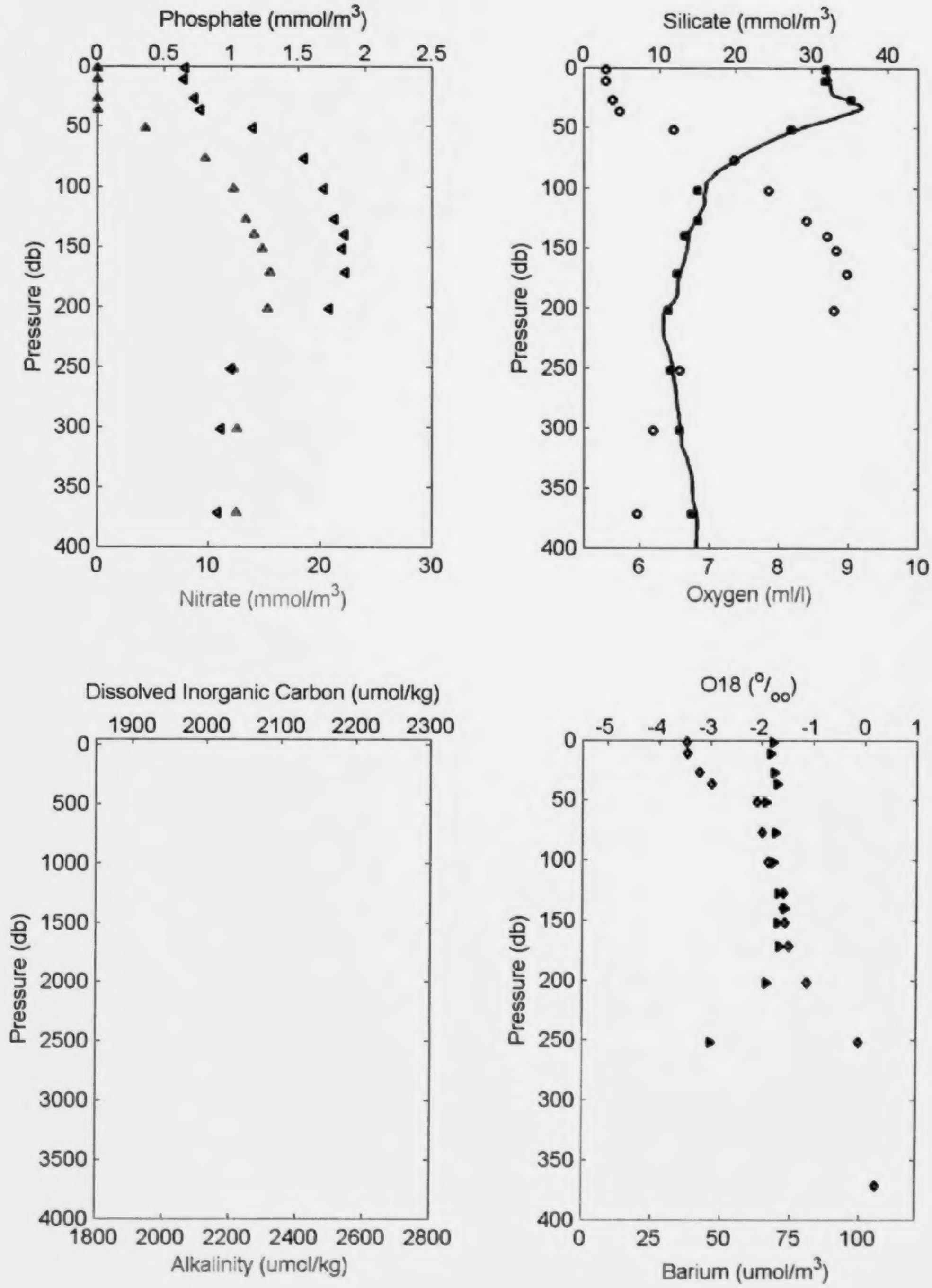
2003-21: Cast 11 Station LS10



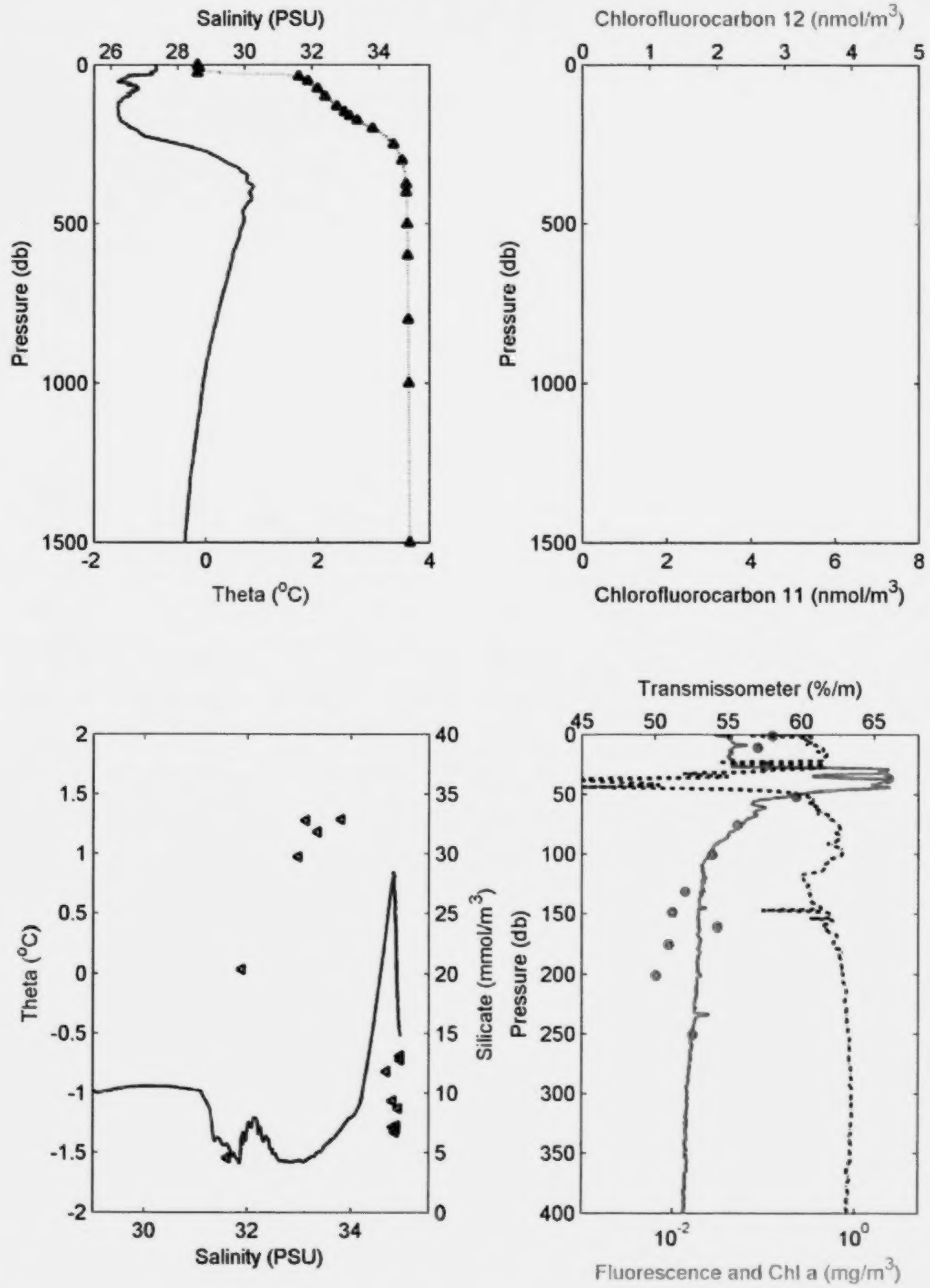
2003-21: Cast 12 Station LS11



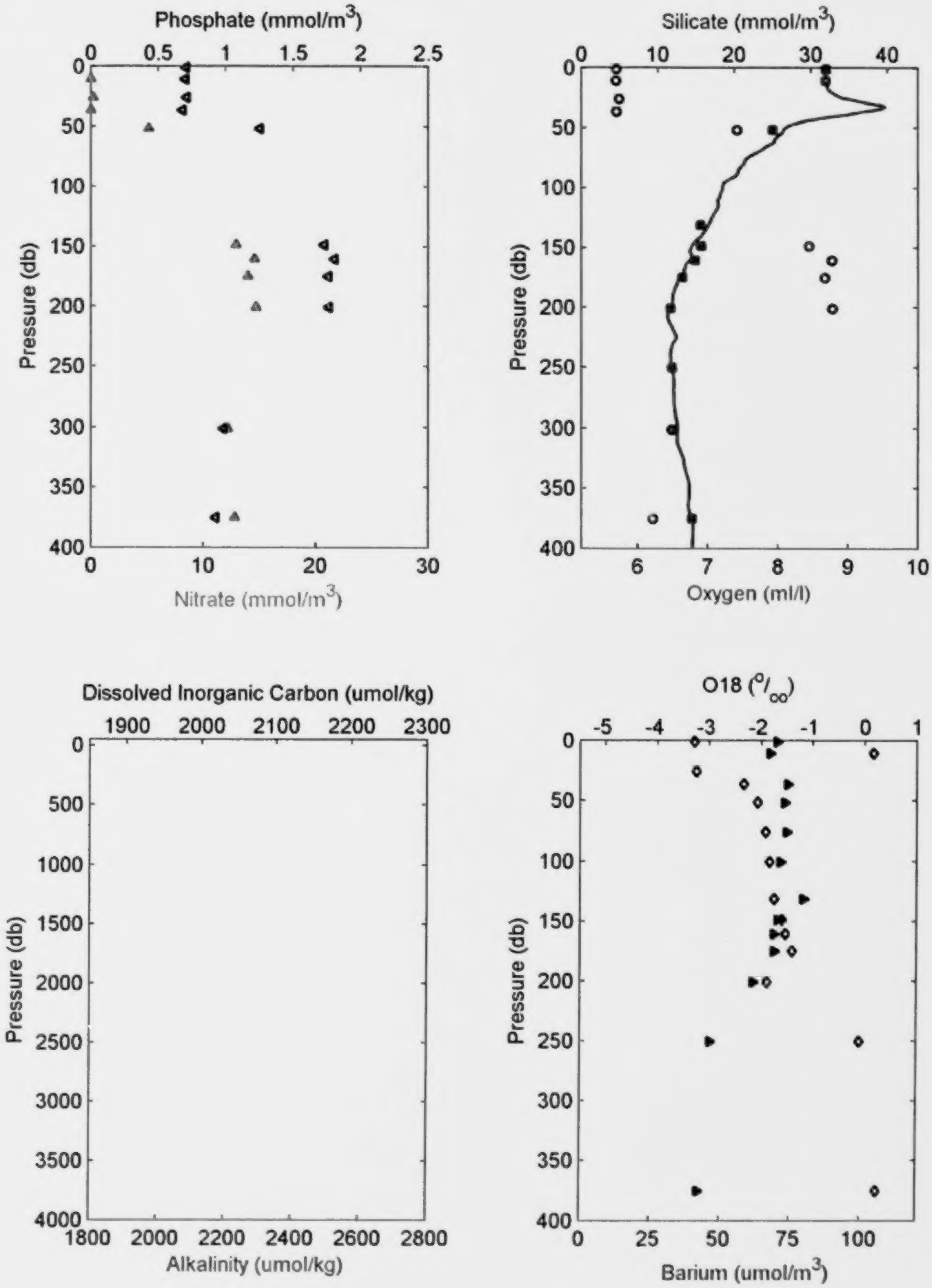
2003-21: Cast 12 Station LS11



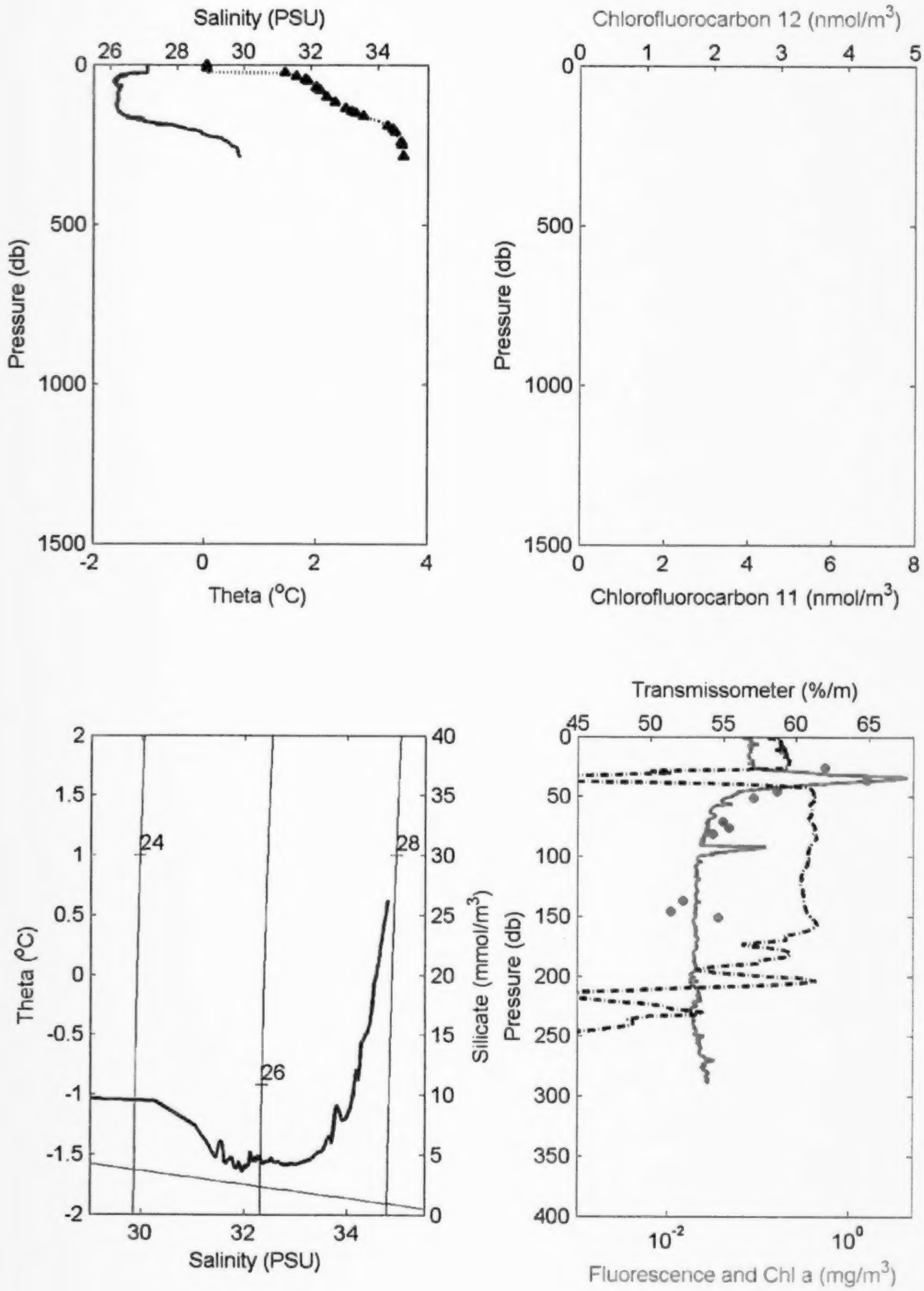
2003-21: Cast 13 Station LS12



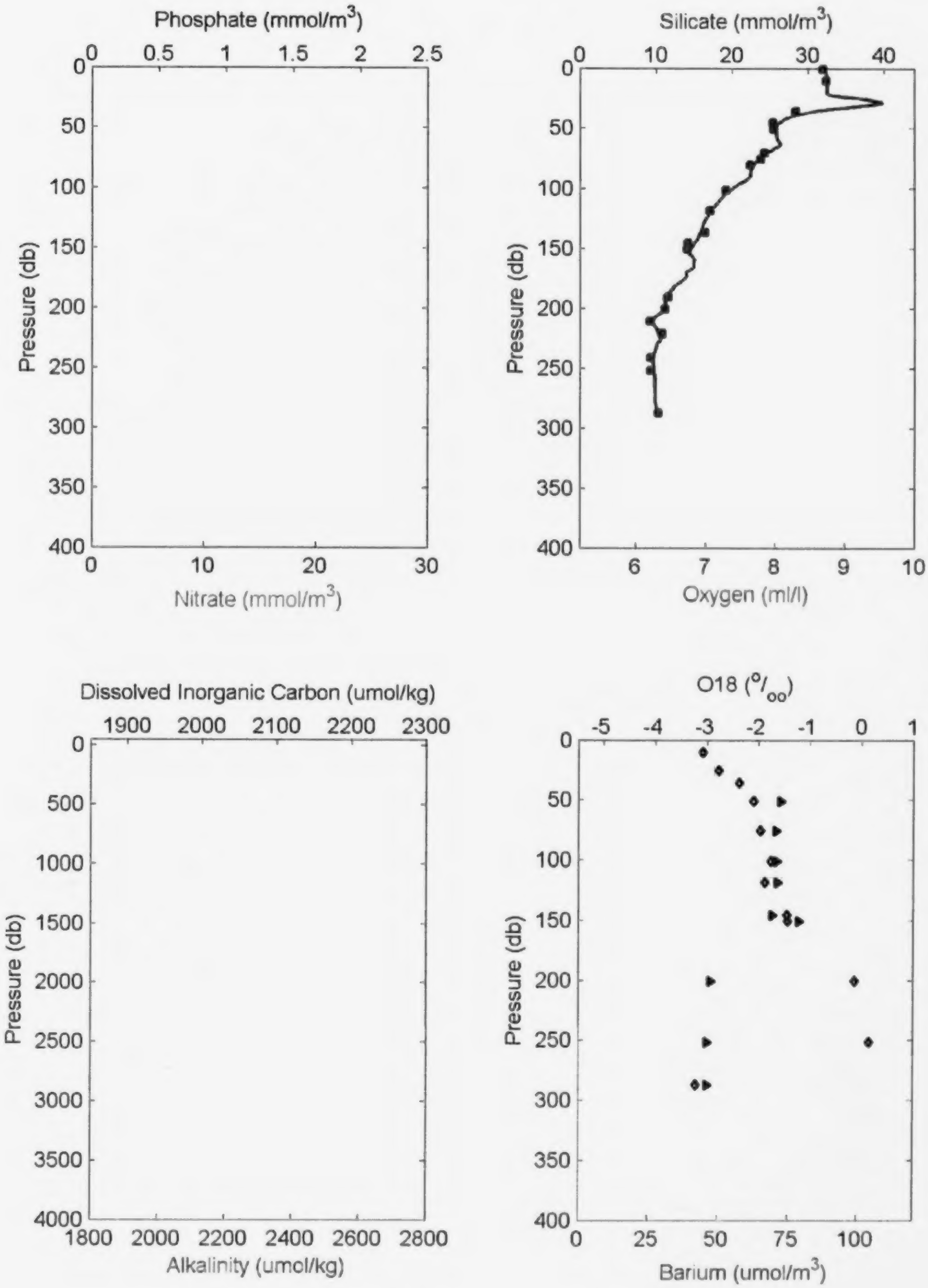
2003-21: Cast 13 Station LS12



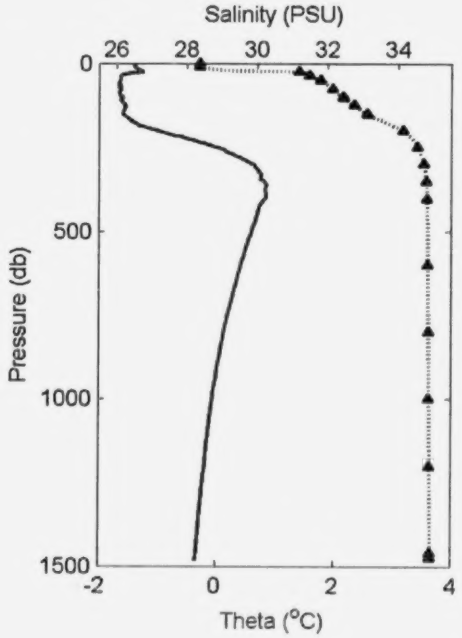
2003-21: Cast 14 Station LS13

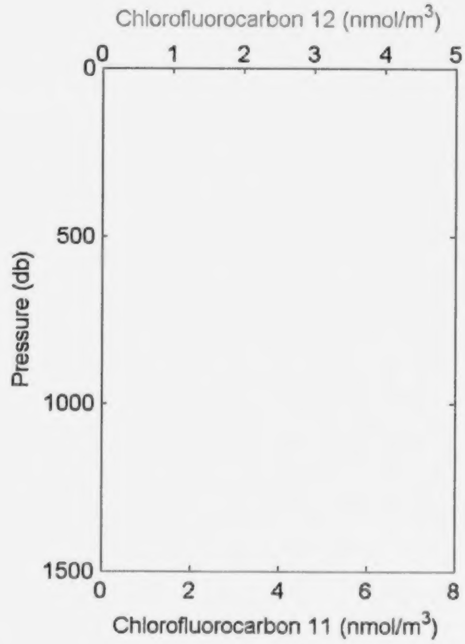


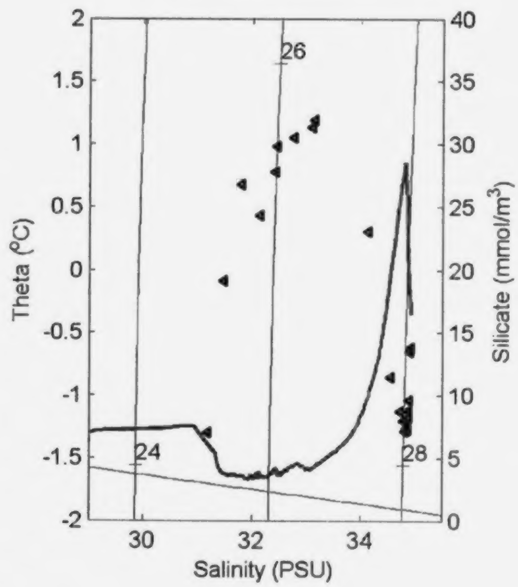
2003-21: Cast 14 Station LS13

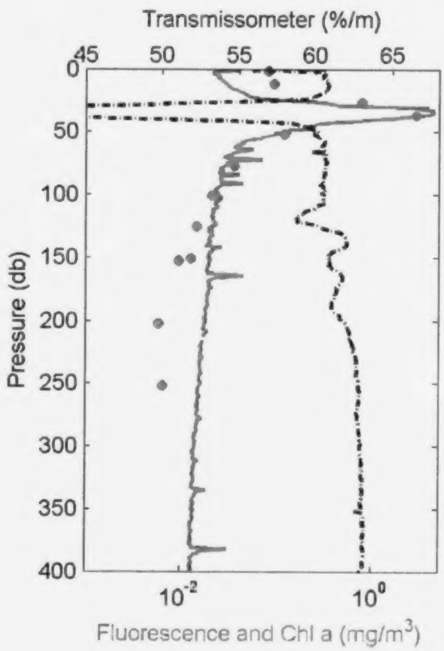


2003-21: Cast 15 Station LS14

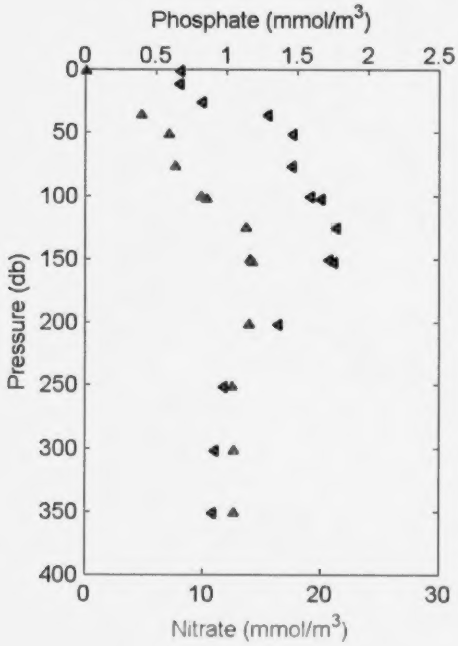


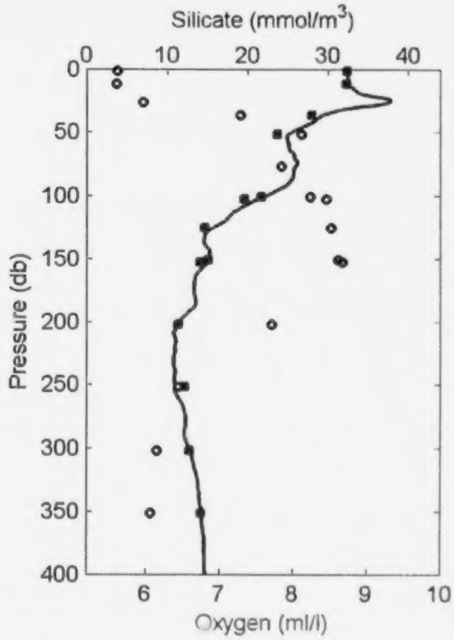


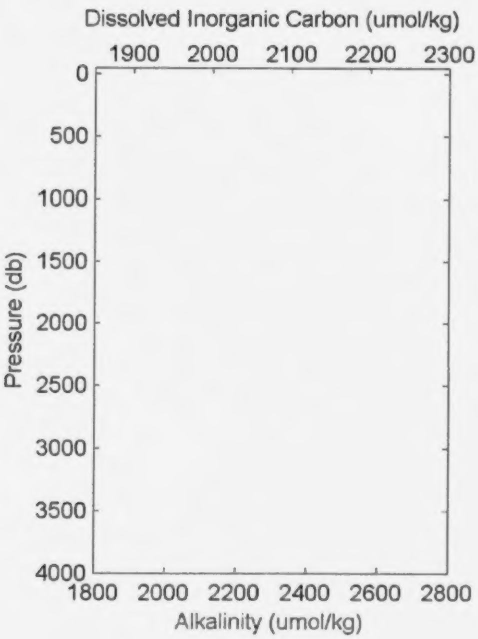


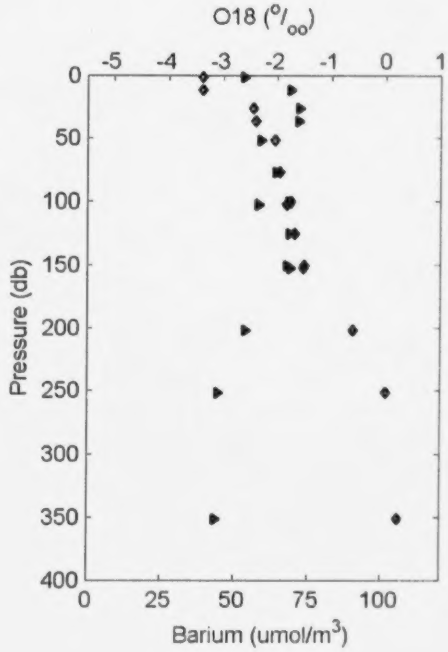


2003-21: Cast 15 Station LS14

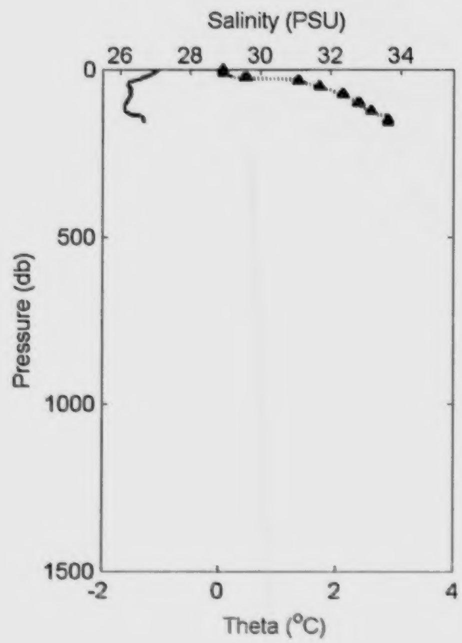


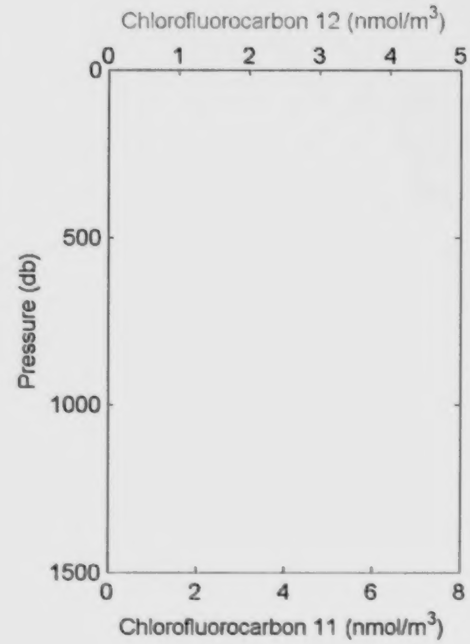


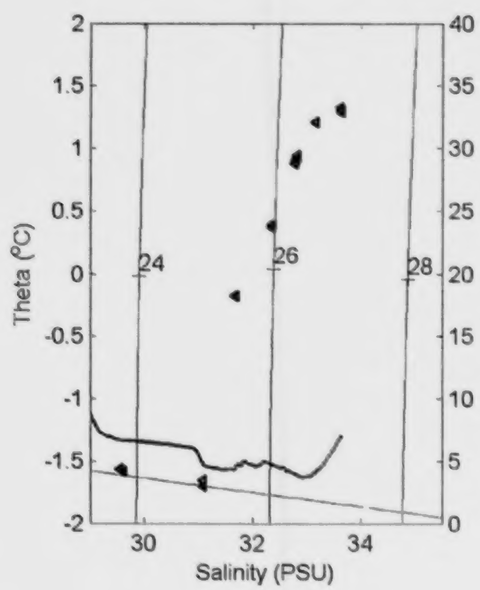


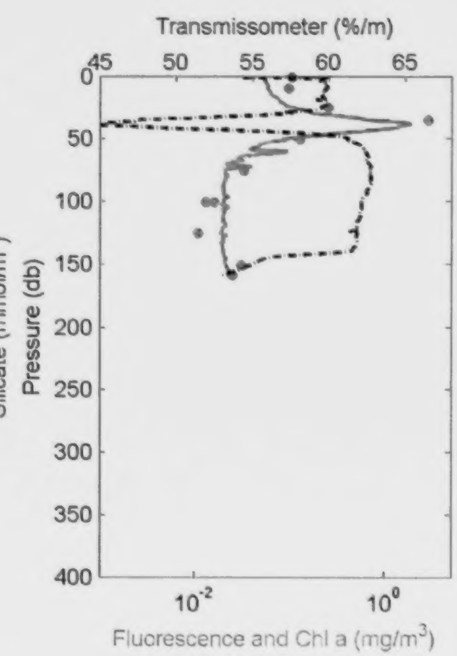


2003-21: Cast 16 Station LS15

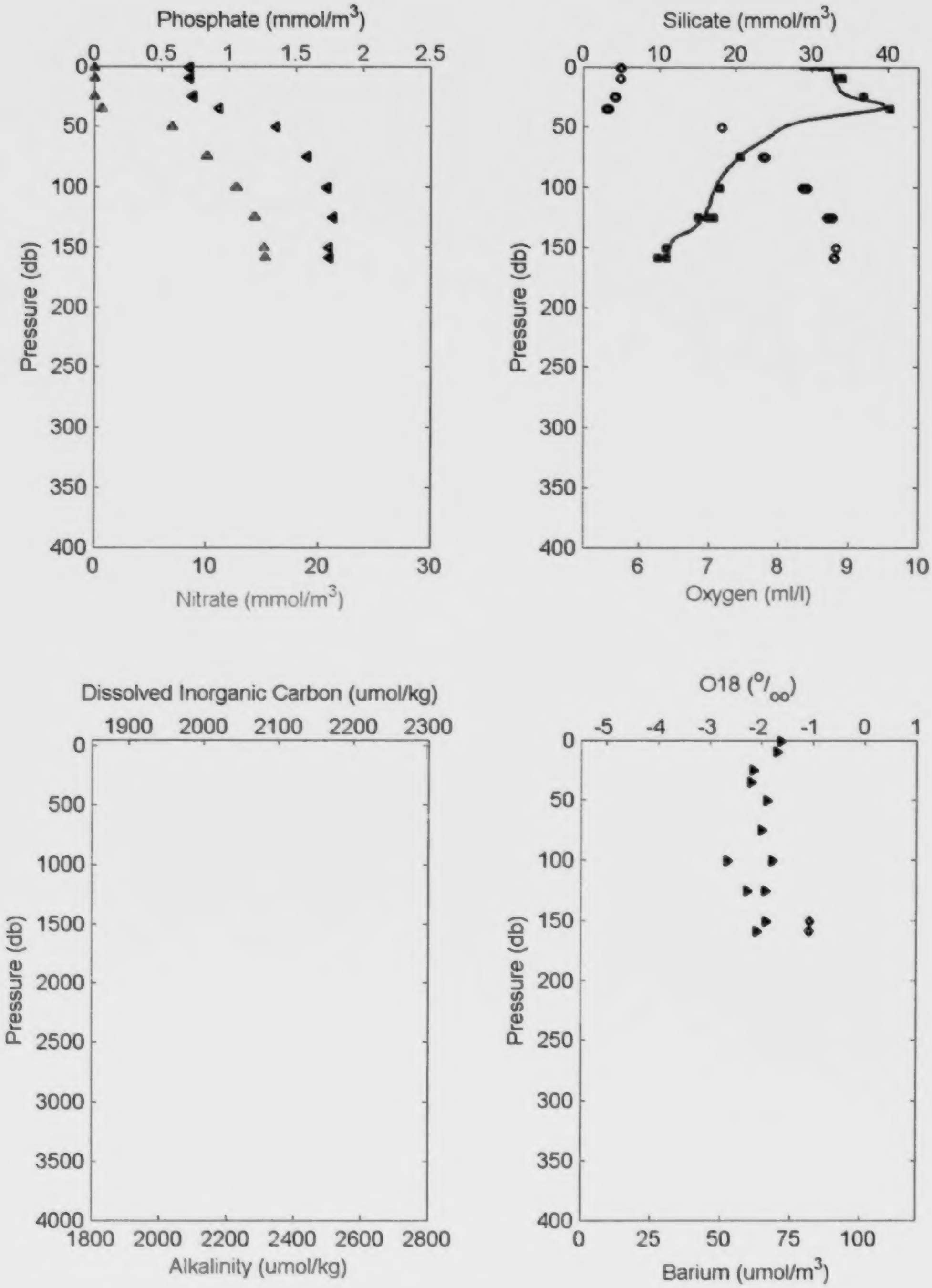




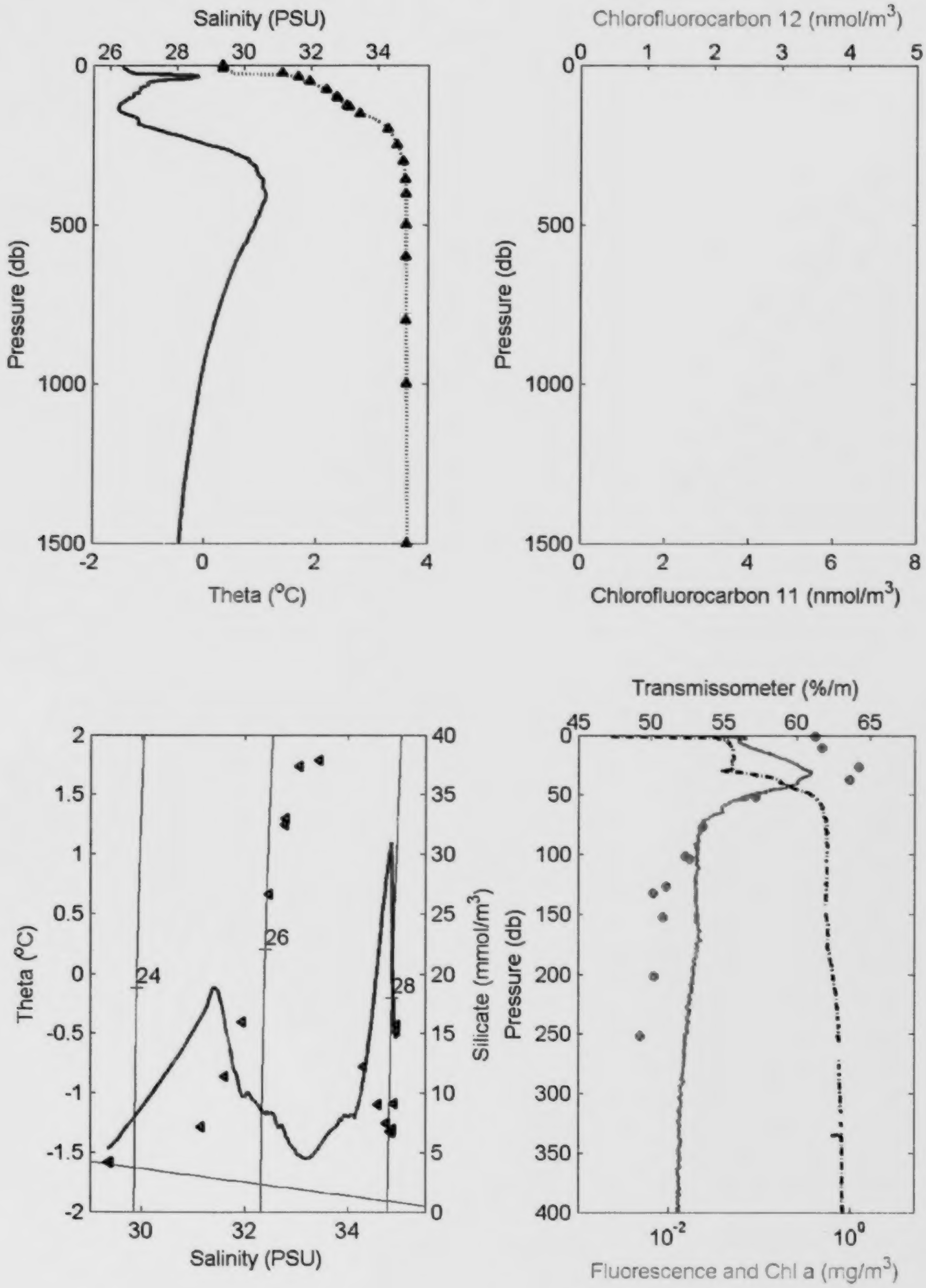




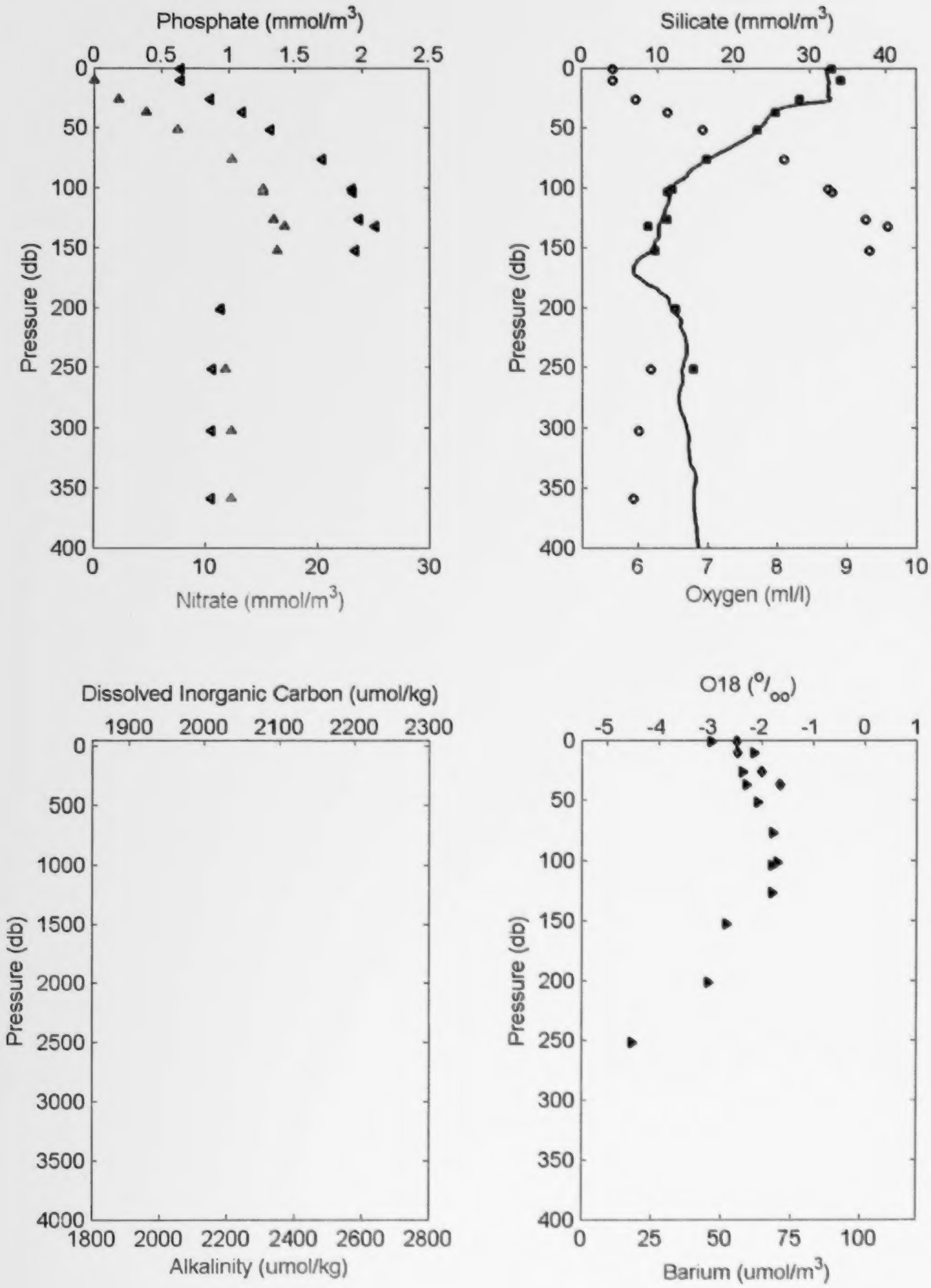
2003-21: Cast 16 Station LS15



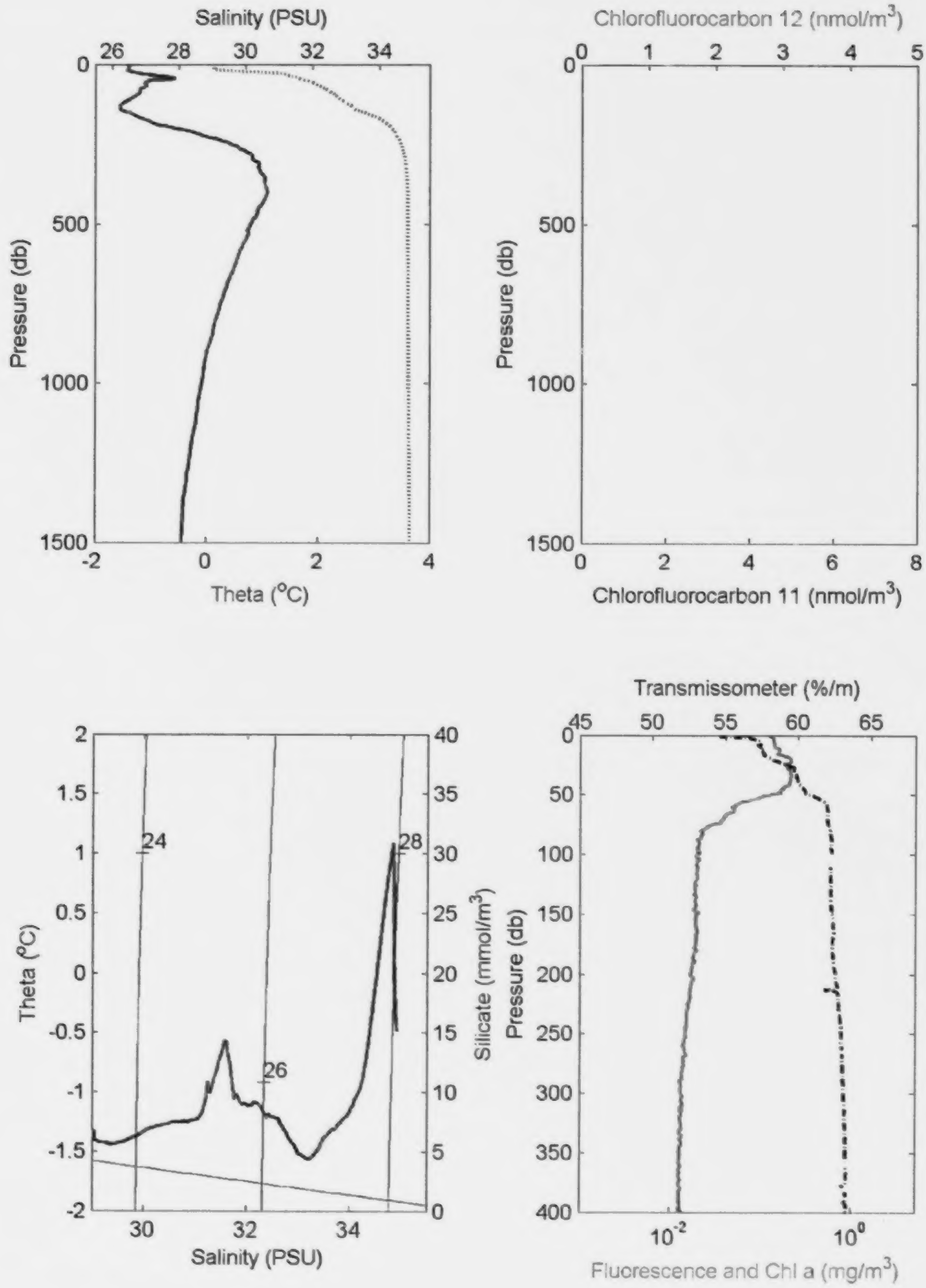
2003-21: Cast 17 Station LS16



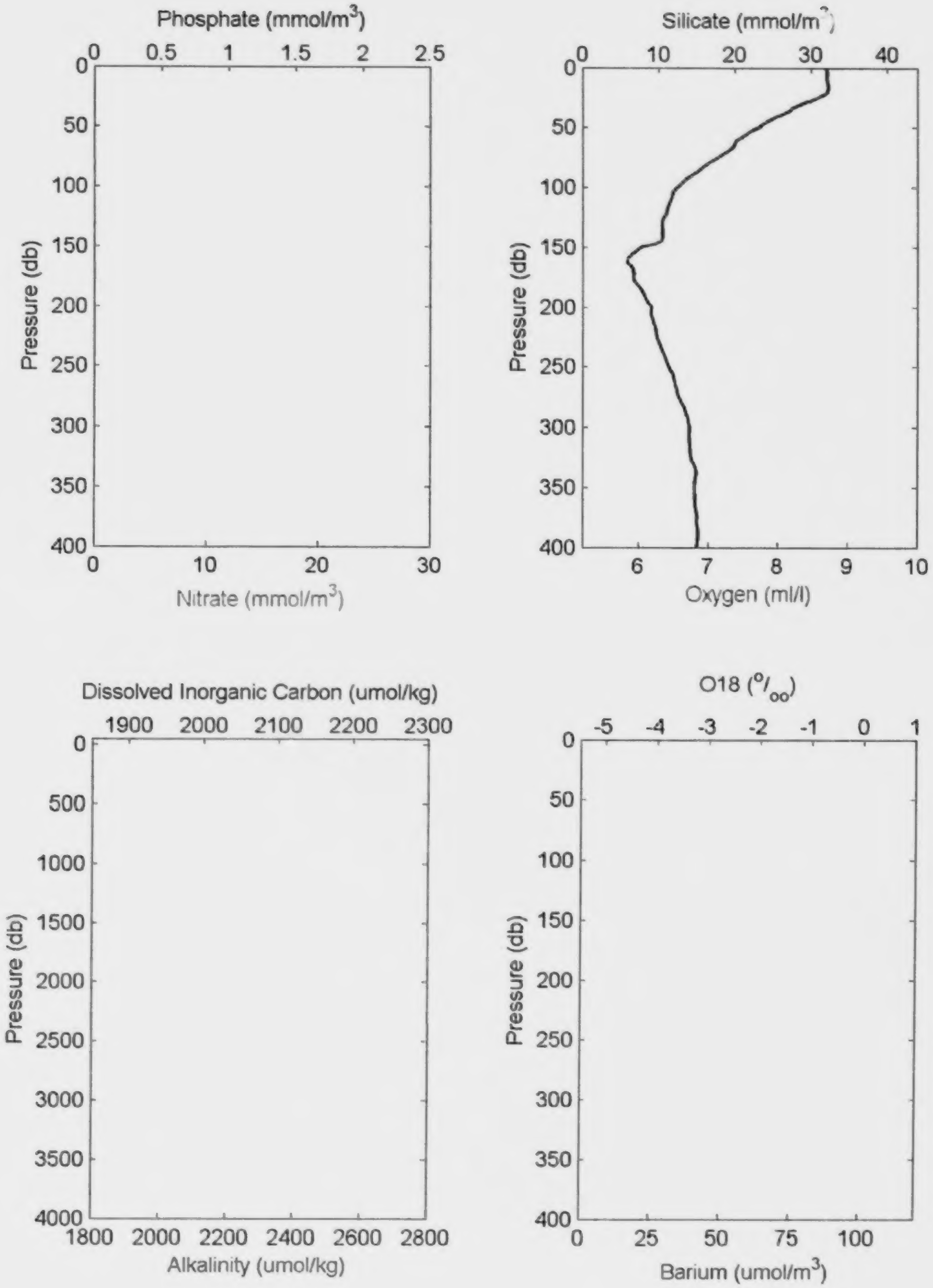
2003-21: Cast 17 Station LS16



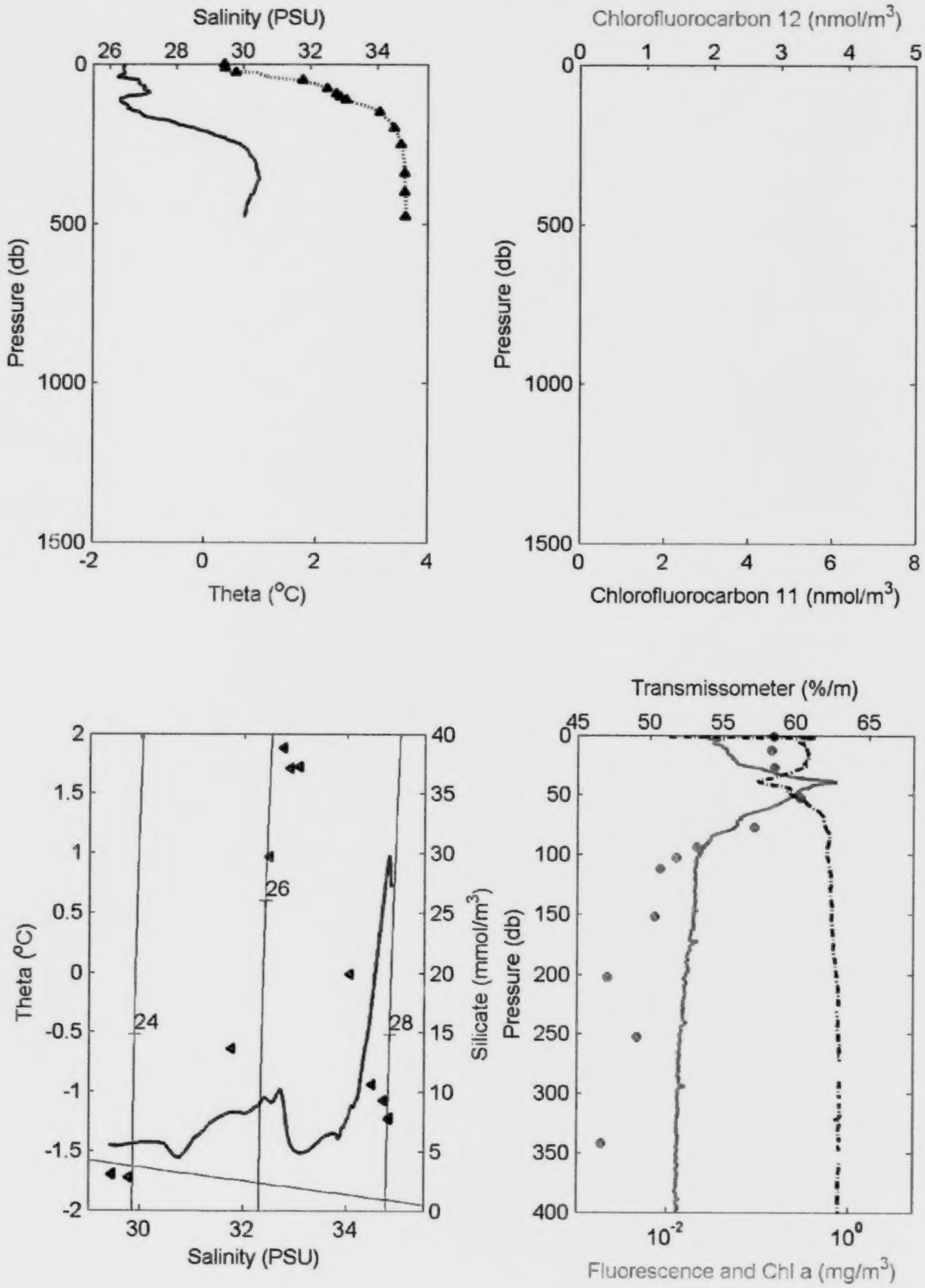
2003-21: Cast 18 Station LS17



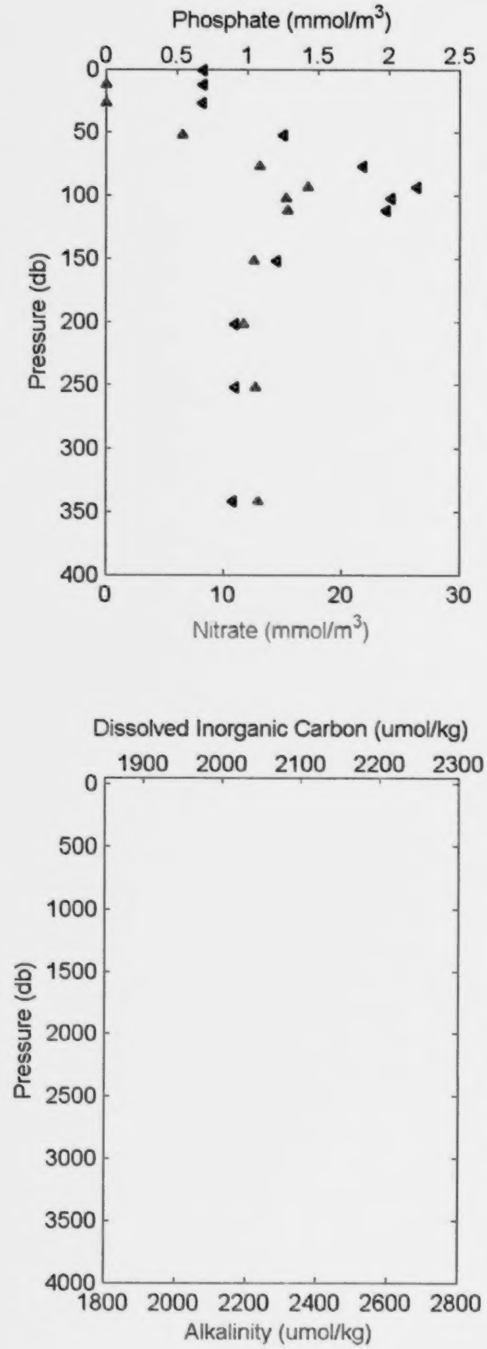
2003-21: Cast 18 Station LS17



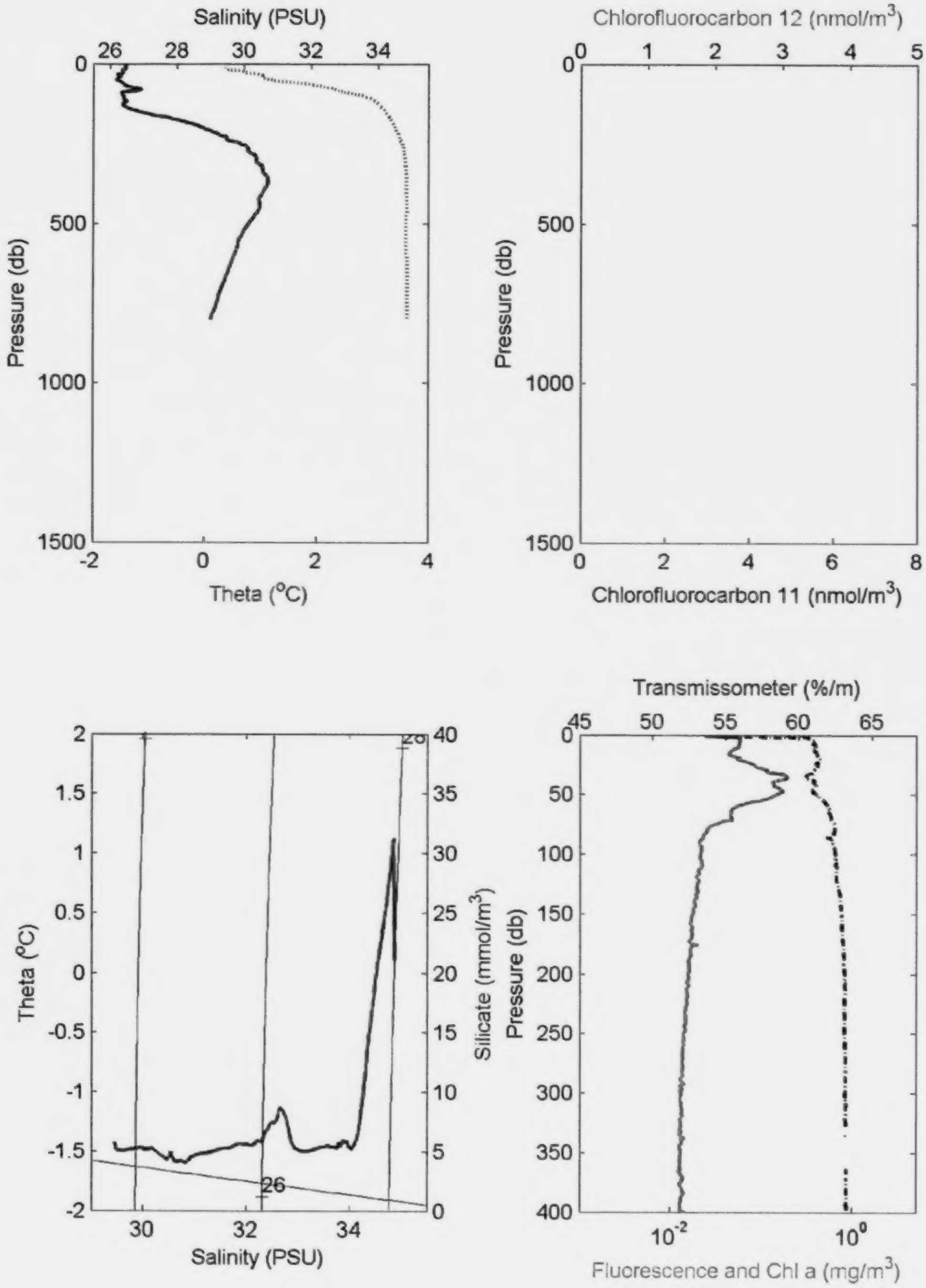
2003-21: Cast 19 Station LS18



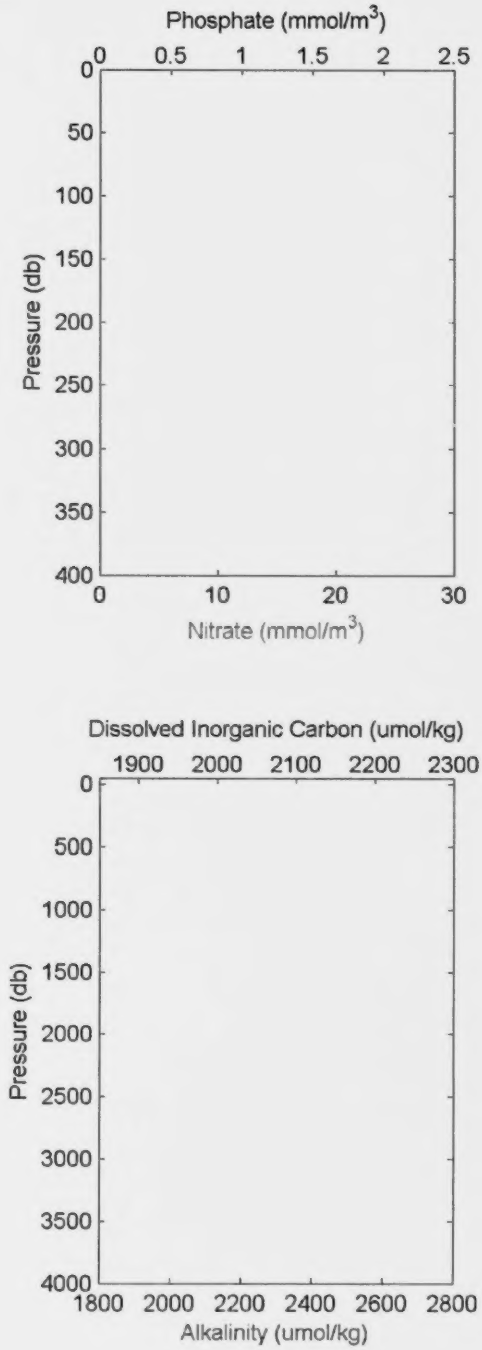
2003-21: Cast 19 Station LS18



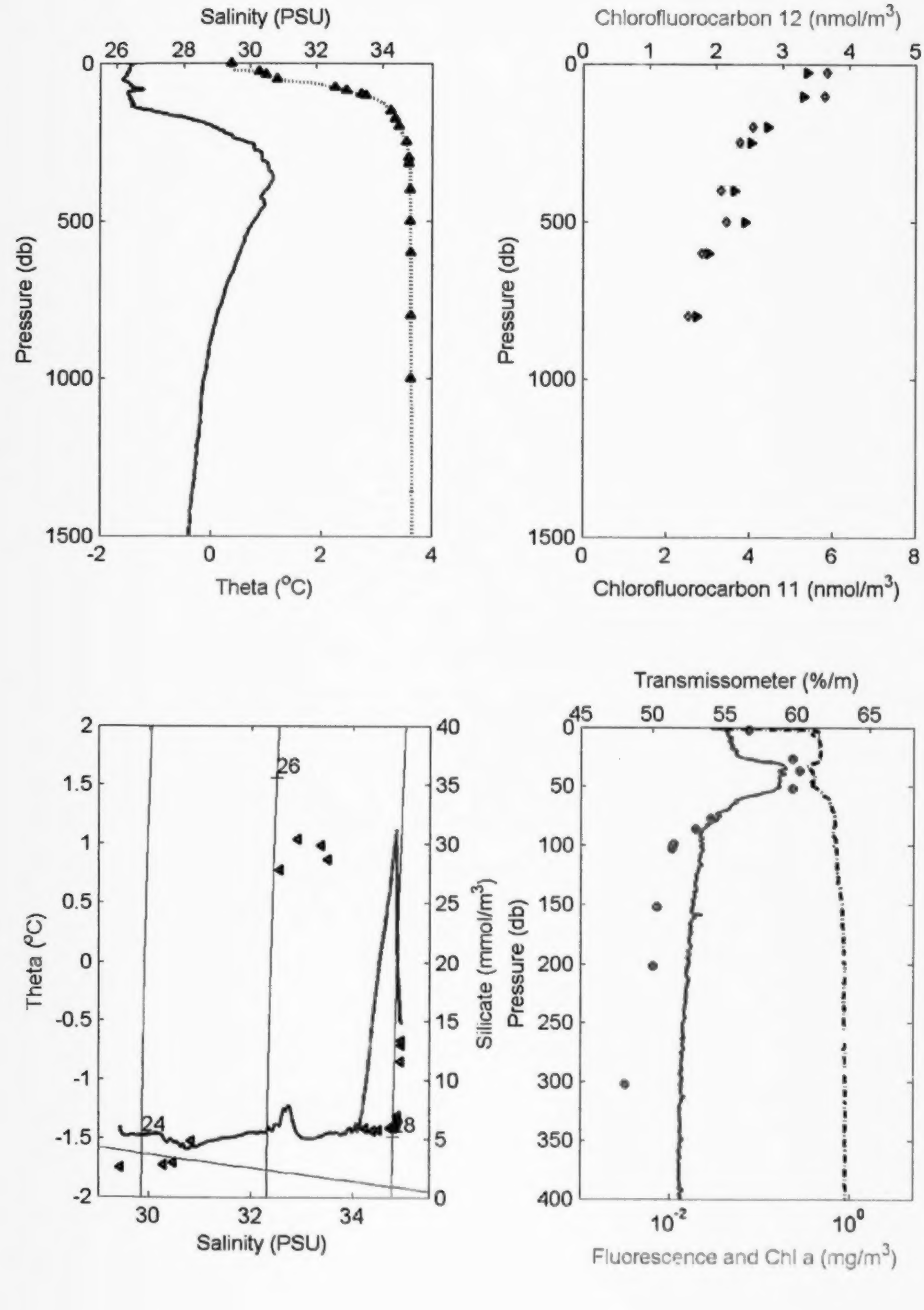
2003-21: Cast 20 Station LS19-1



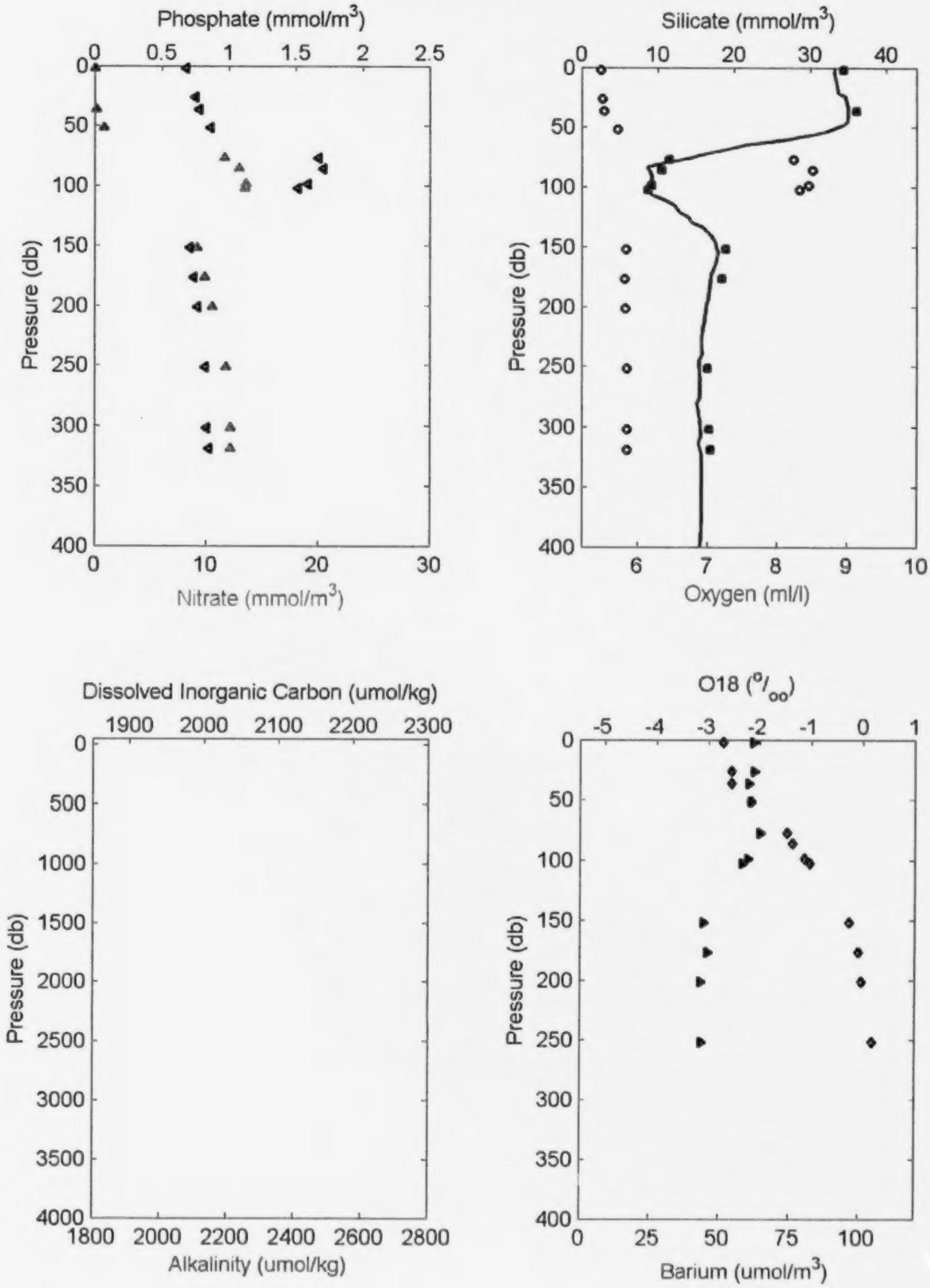
2003-21: Cast 20 Station LS19-1



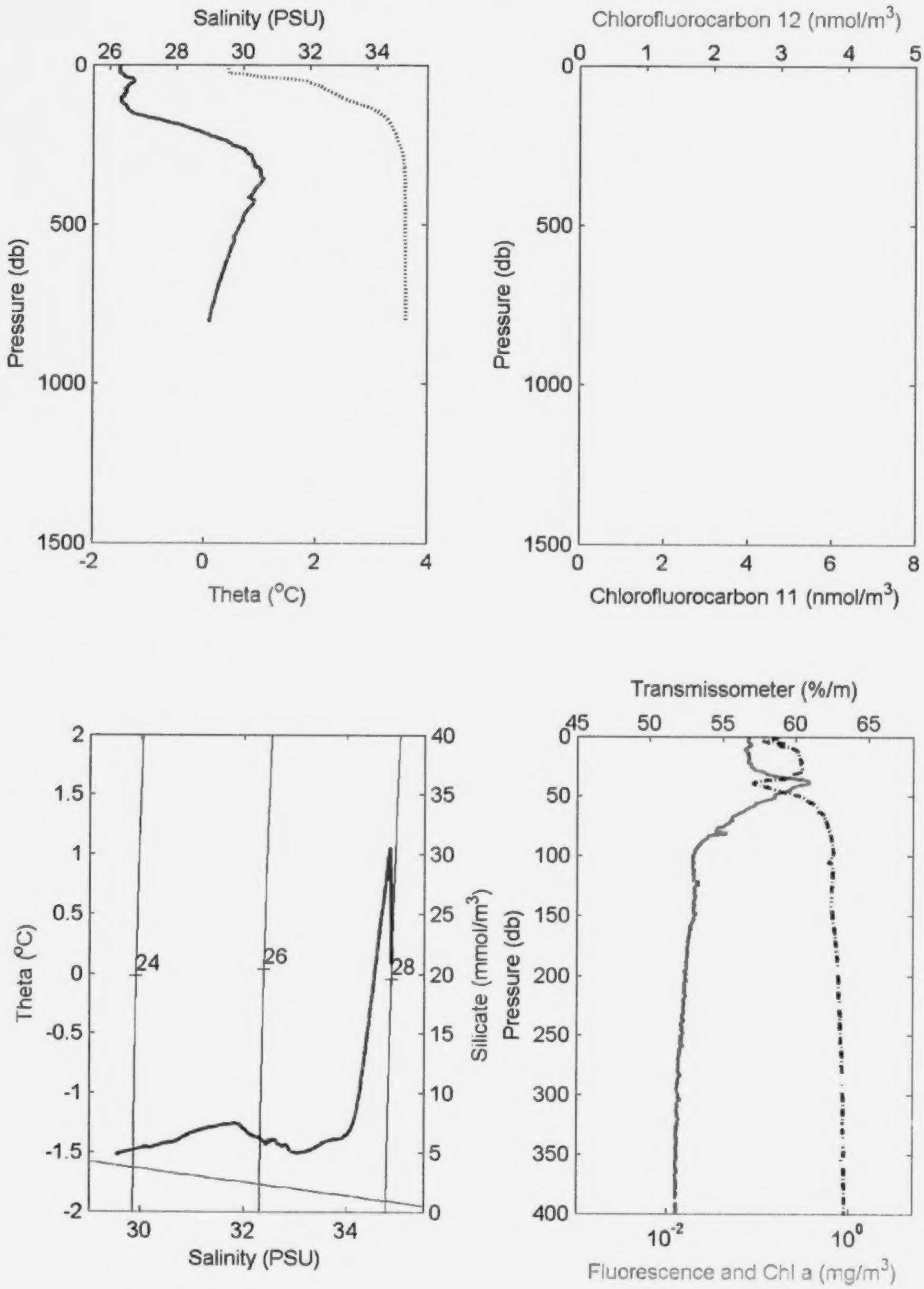
2003-21: Cast 21 Station LS19-2



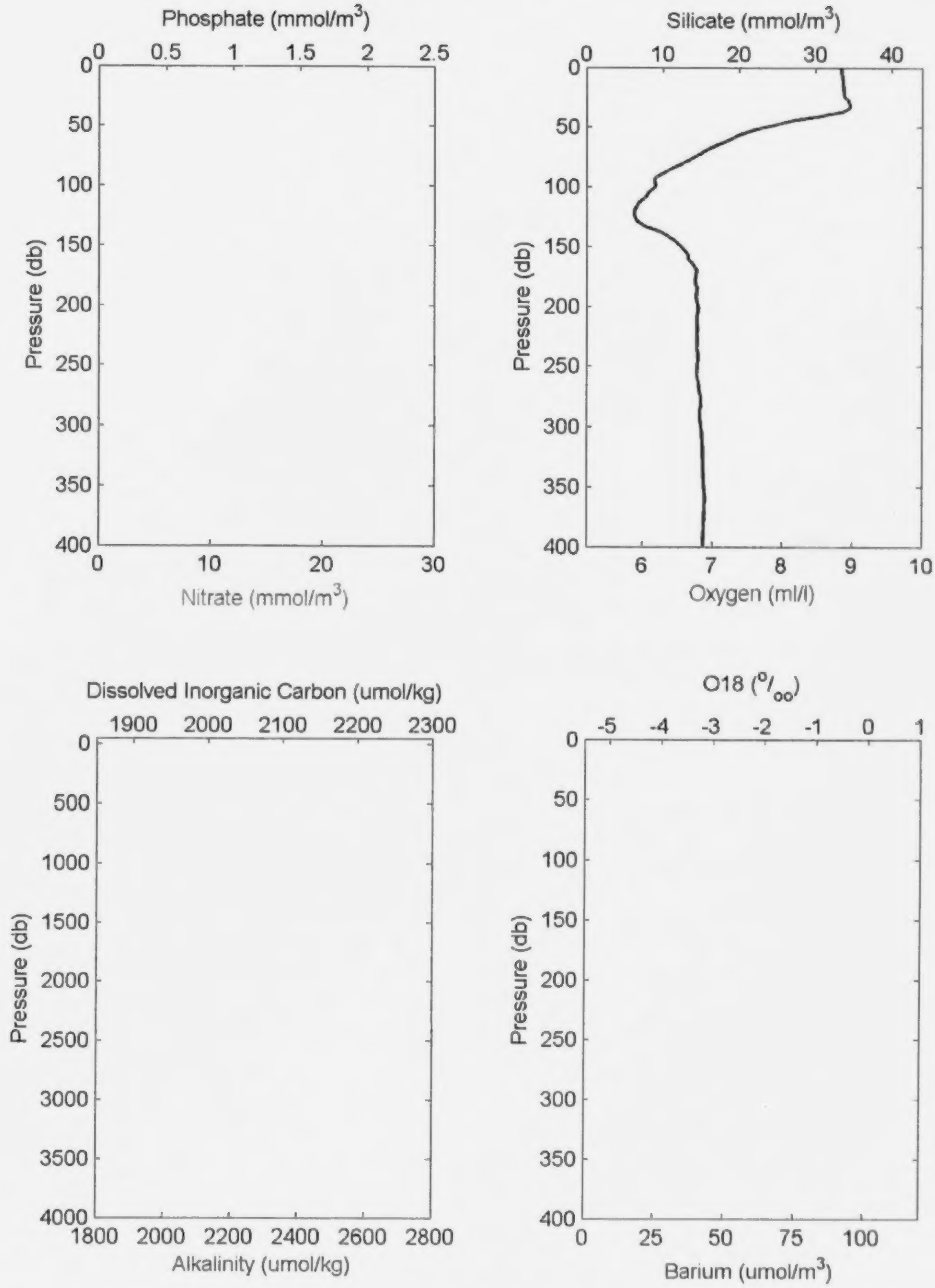
2003-21: Cast 21 Station LS19-2



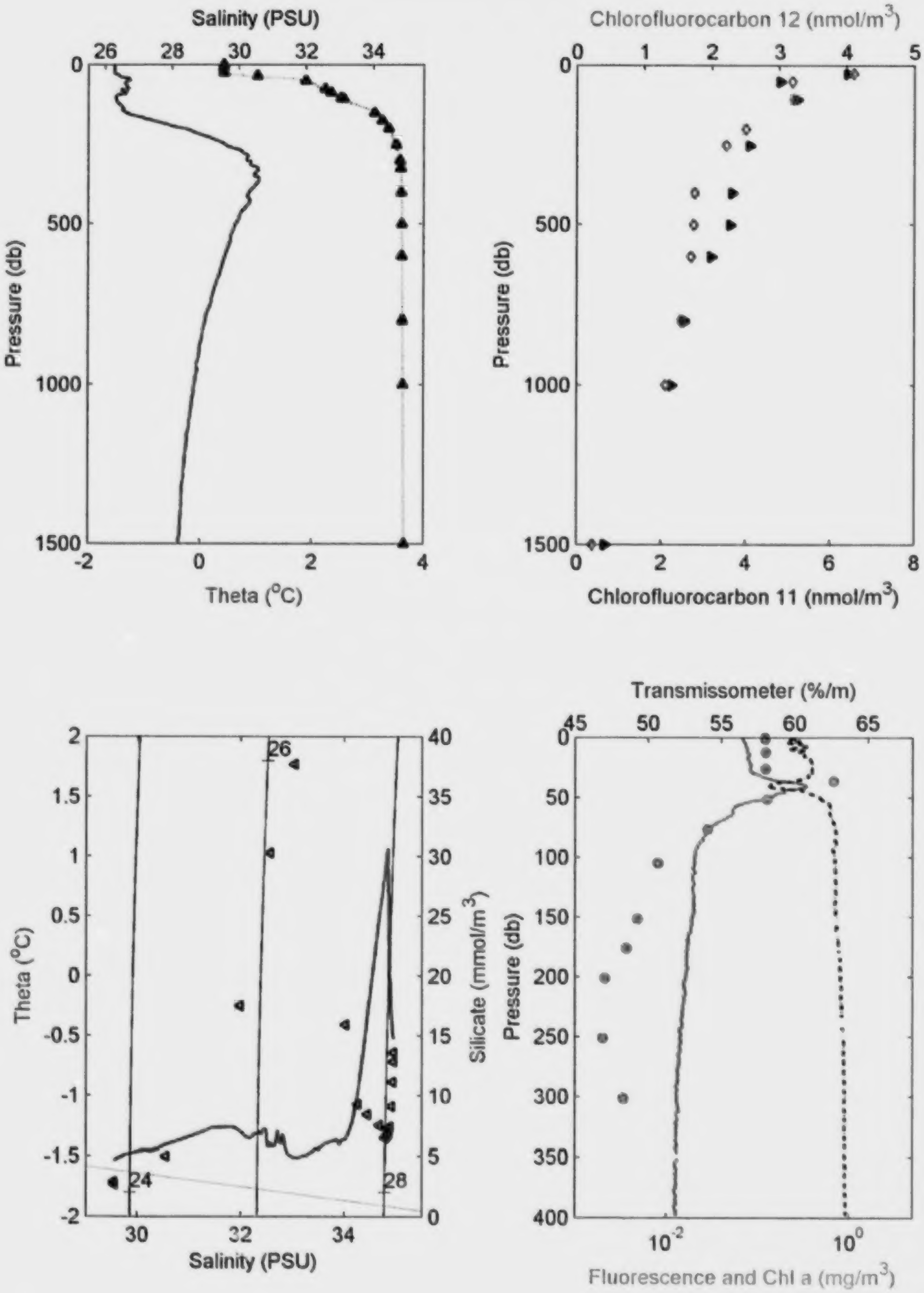
2003-21: Cast 22 Station LS20



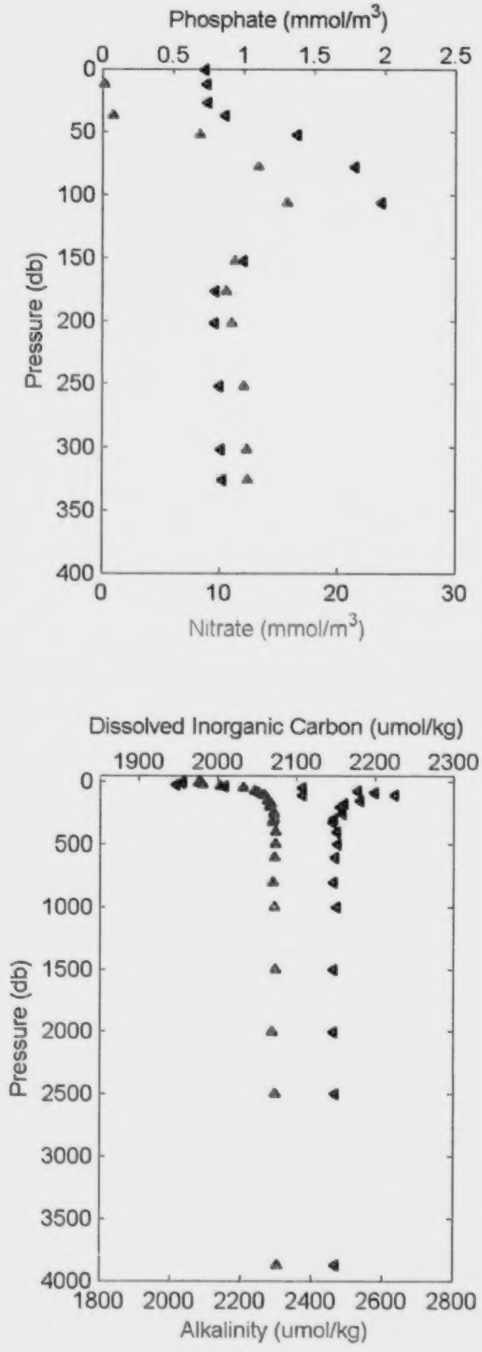
2003-21: Cast 22 Station LS20



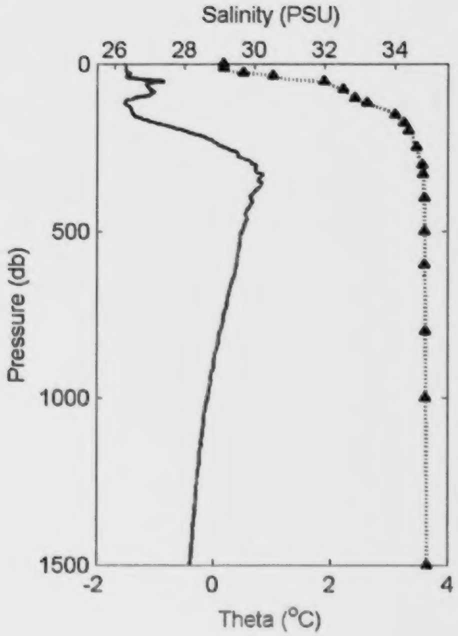
2003-21: Cast 23 Station LS20-2

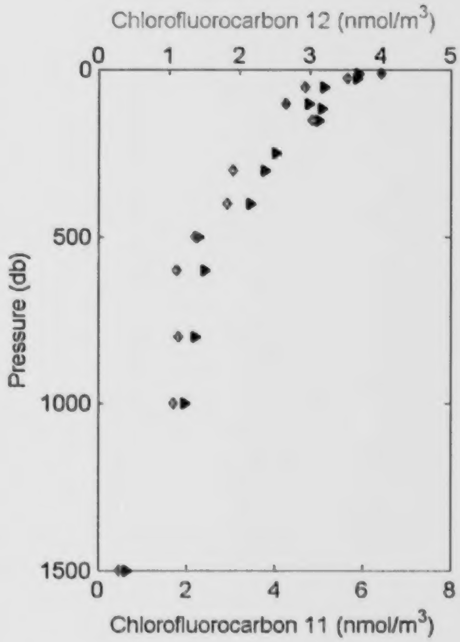


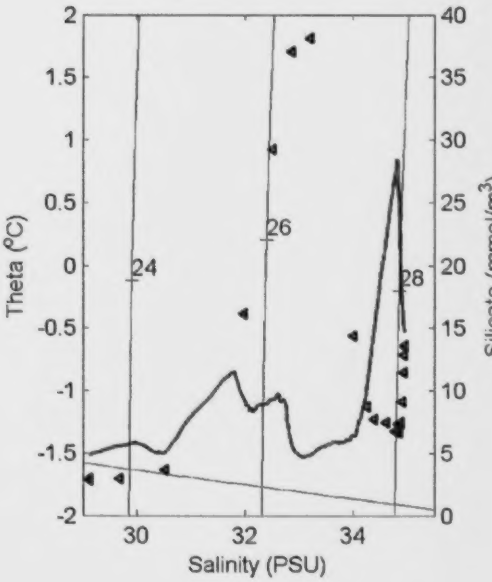
2003-21: Cast 23 Station LS20-2

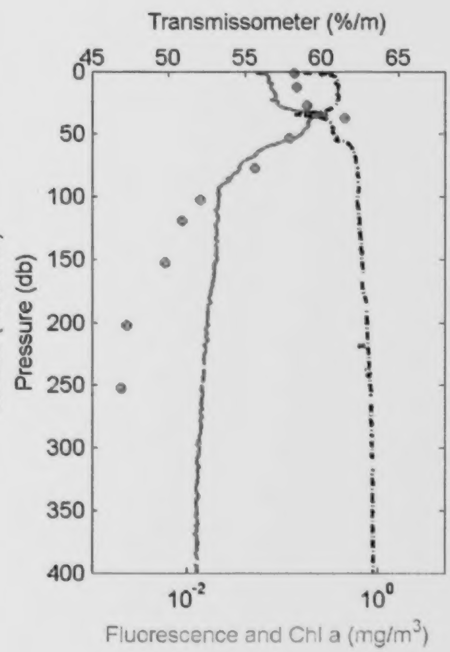


2003-21: Cast 24 Station LS21

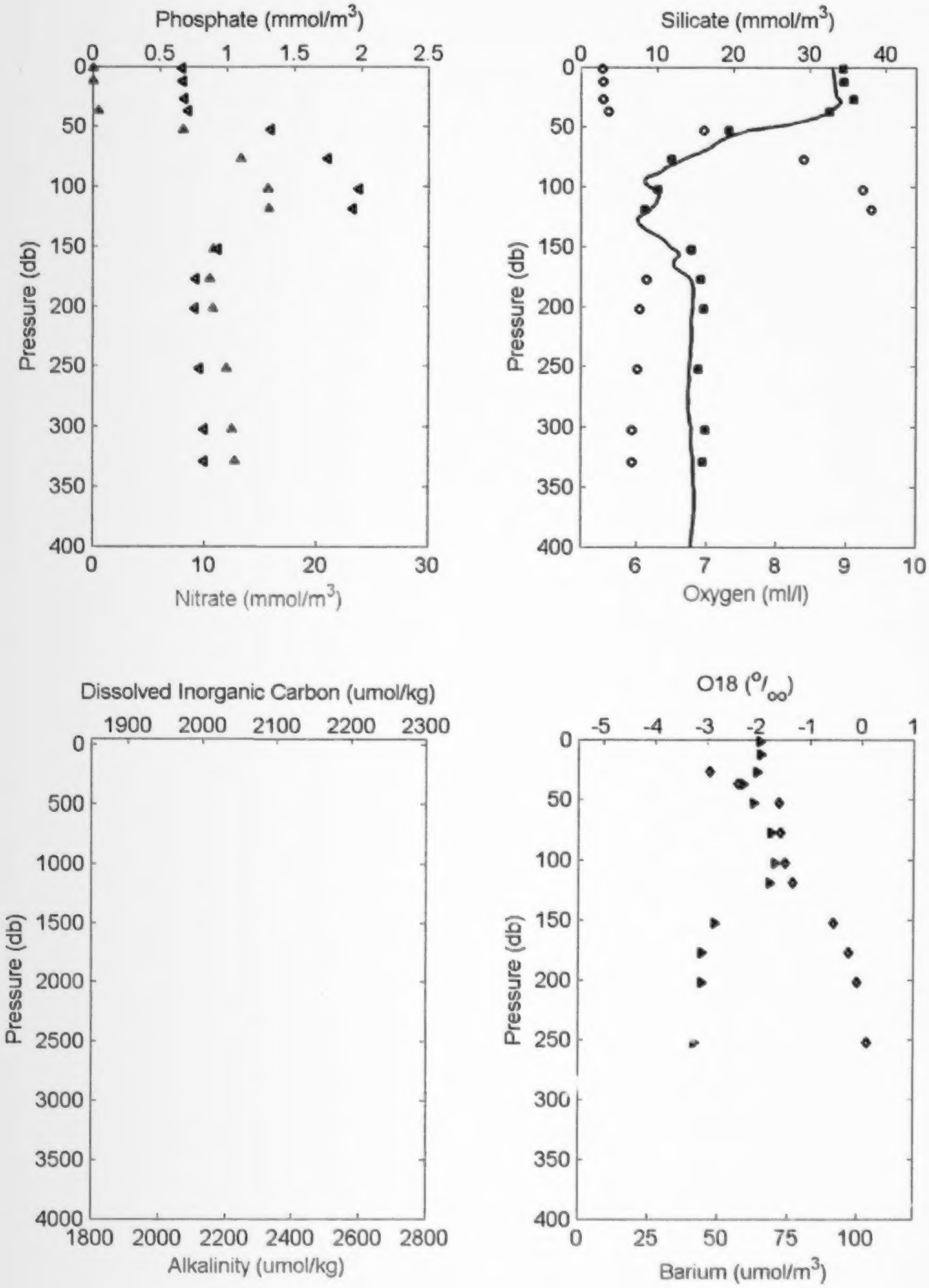




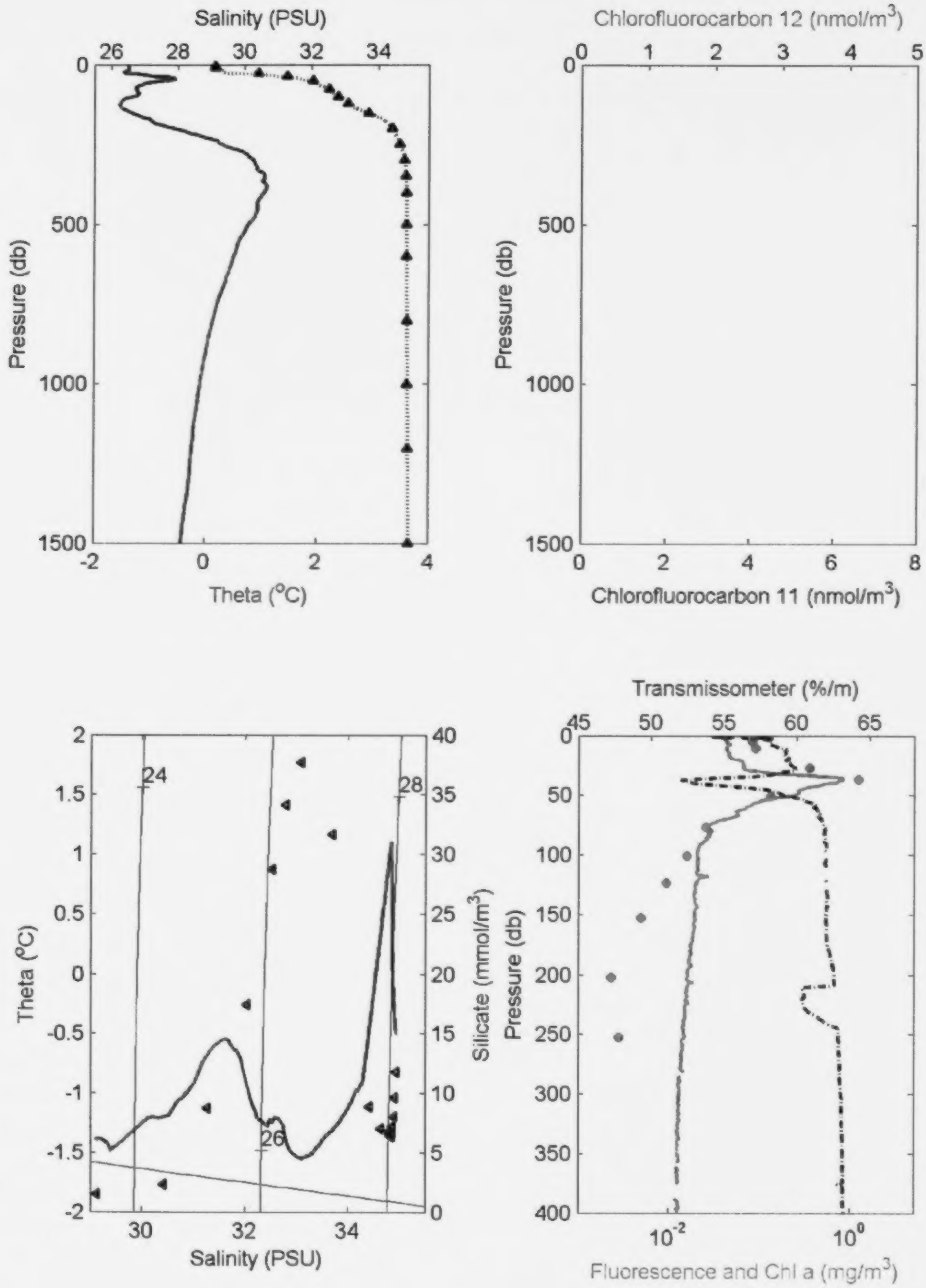




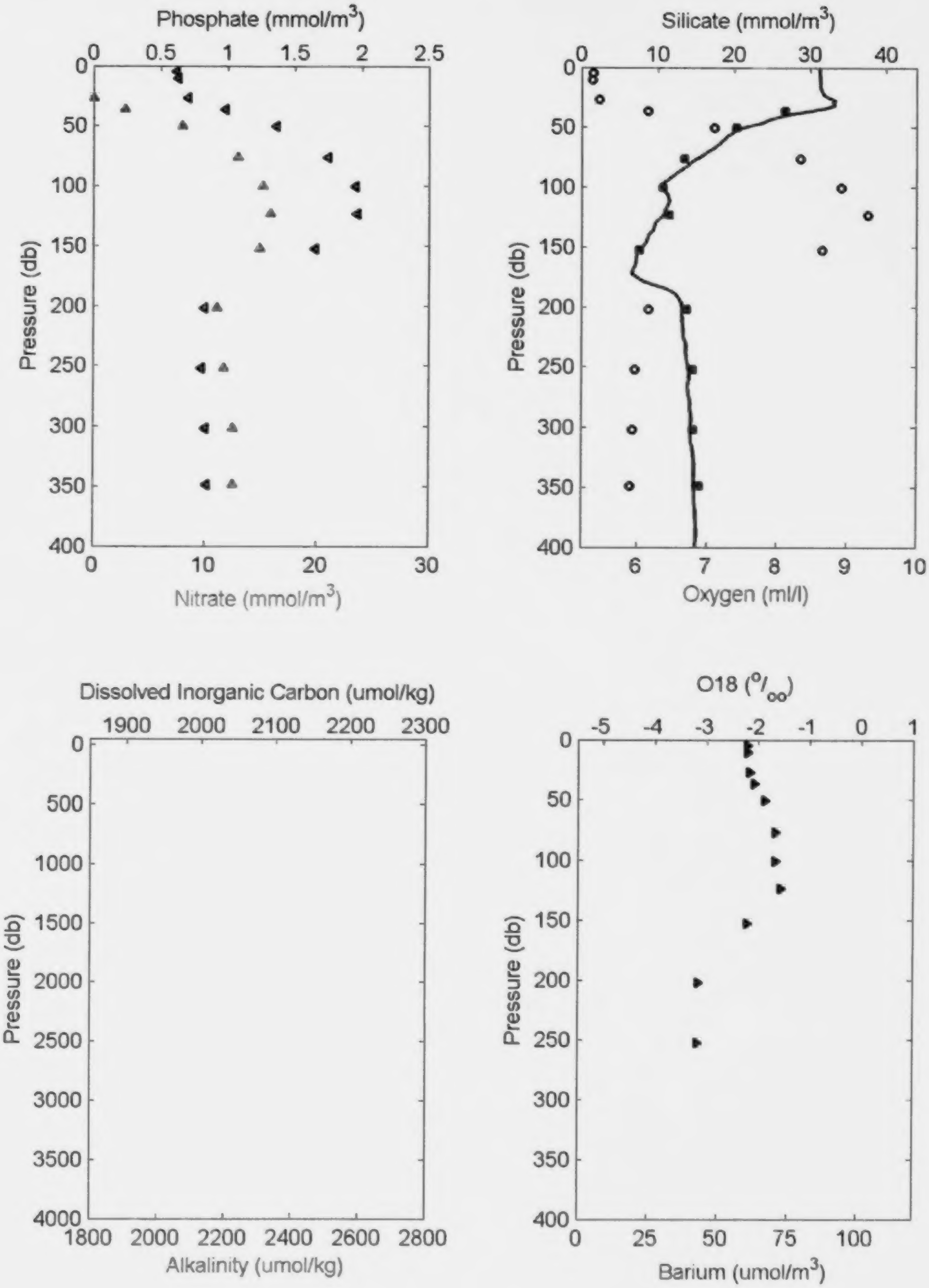
2003-21: Cast 24 Station LS21



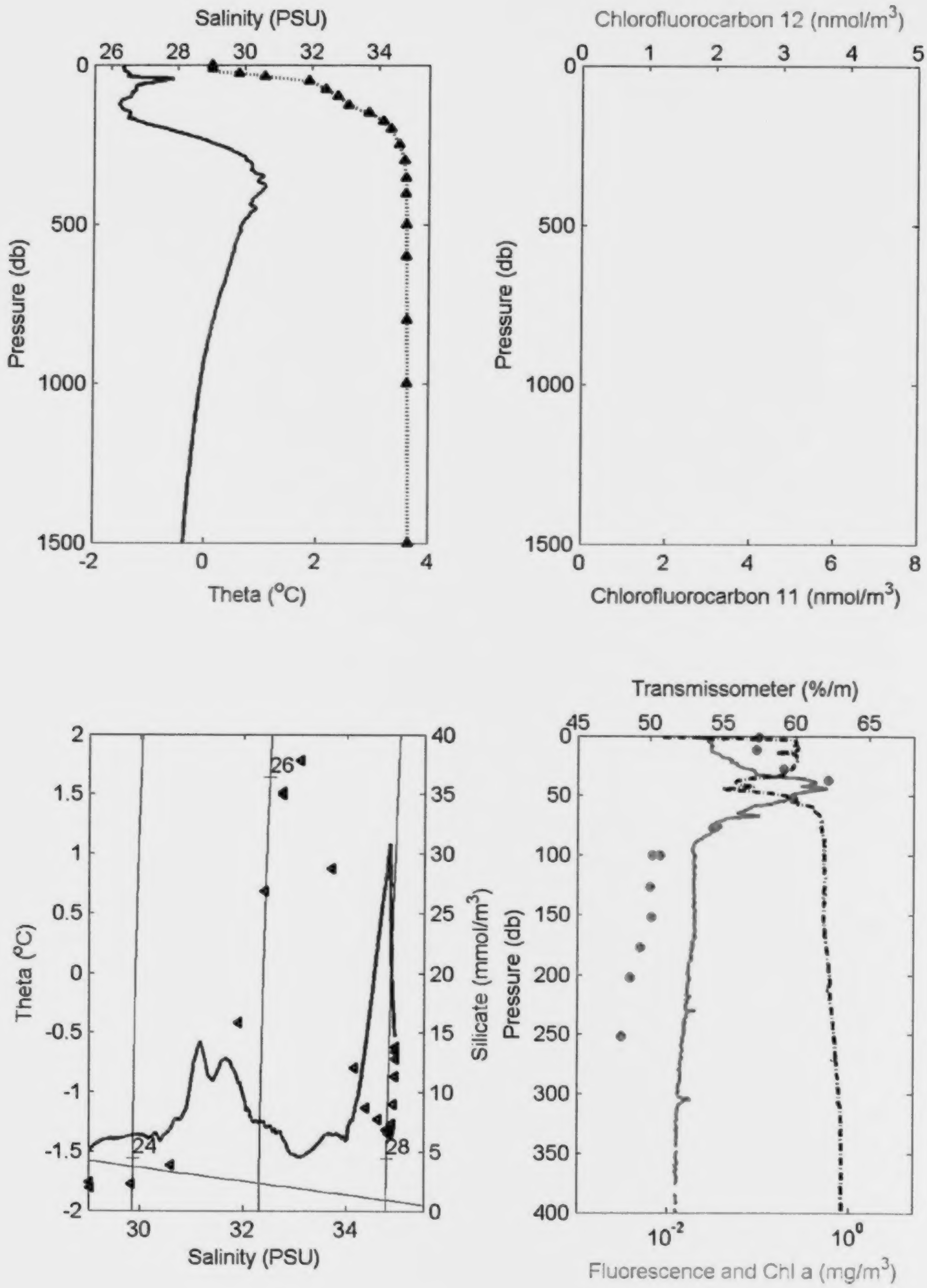
2003-21: Cast 25 Station LS22



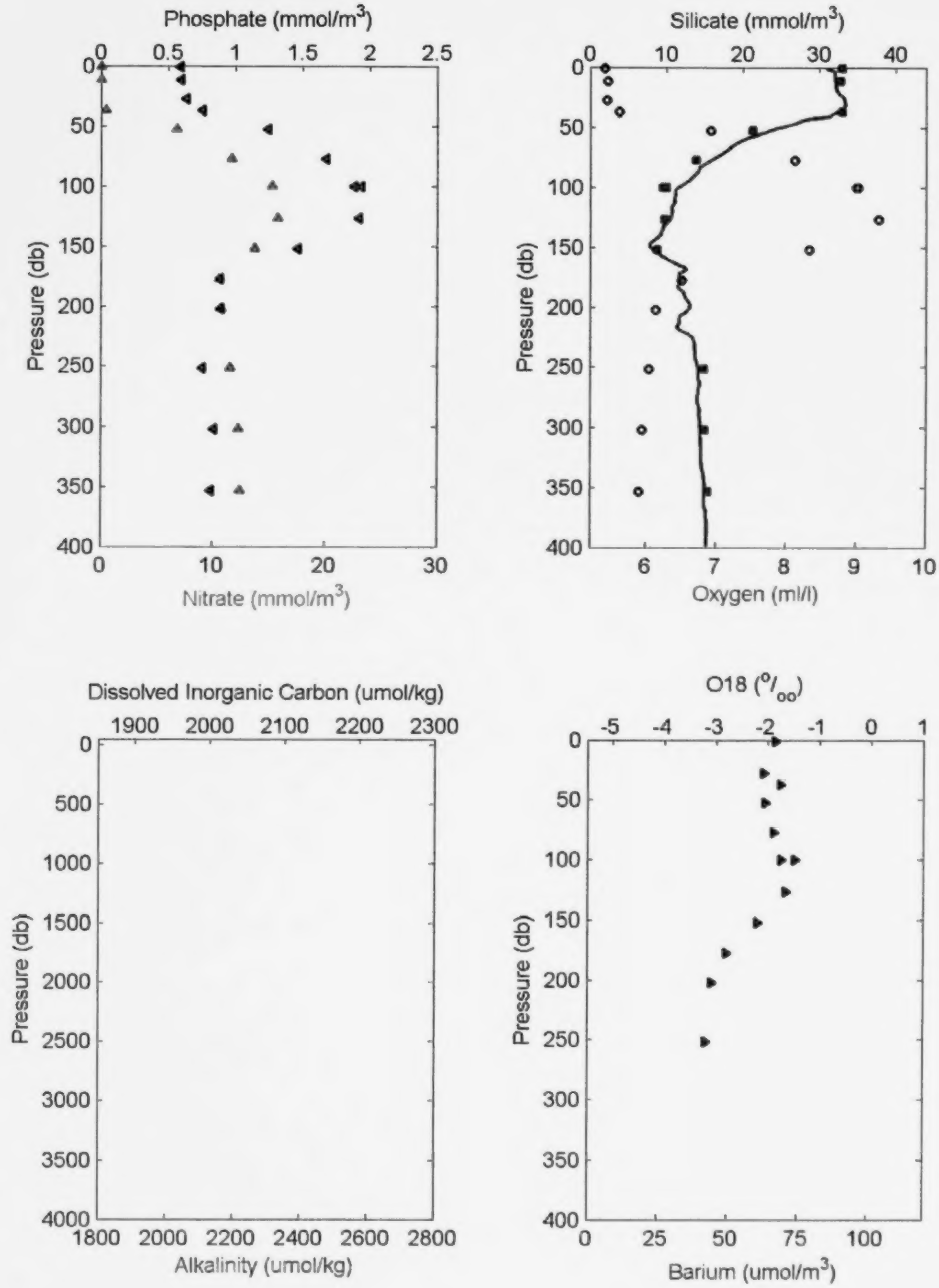
2003-21: Cast 25 Station LS22



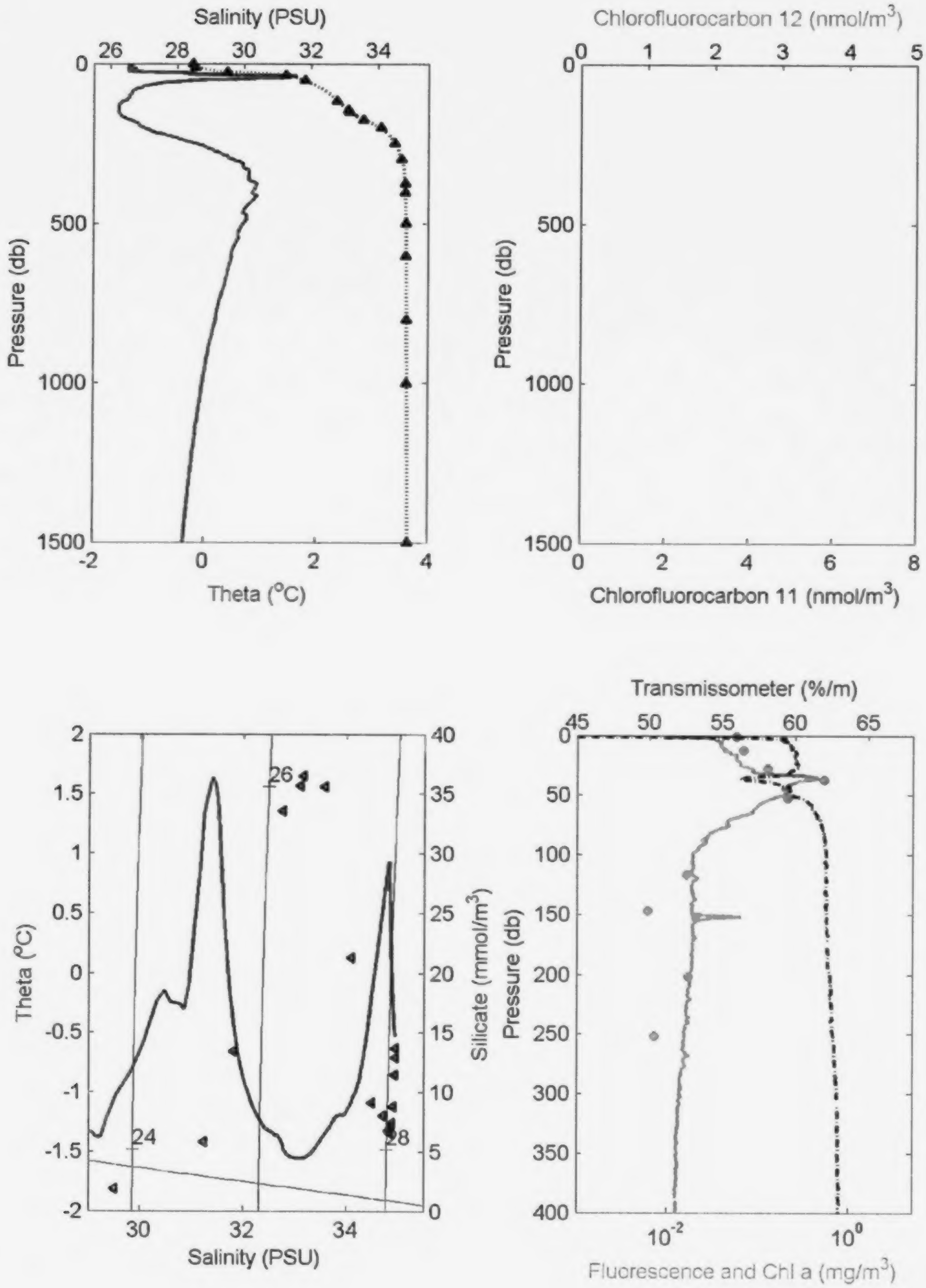
2003-21: Cast 26 Station LS23



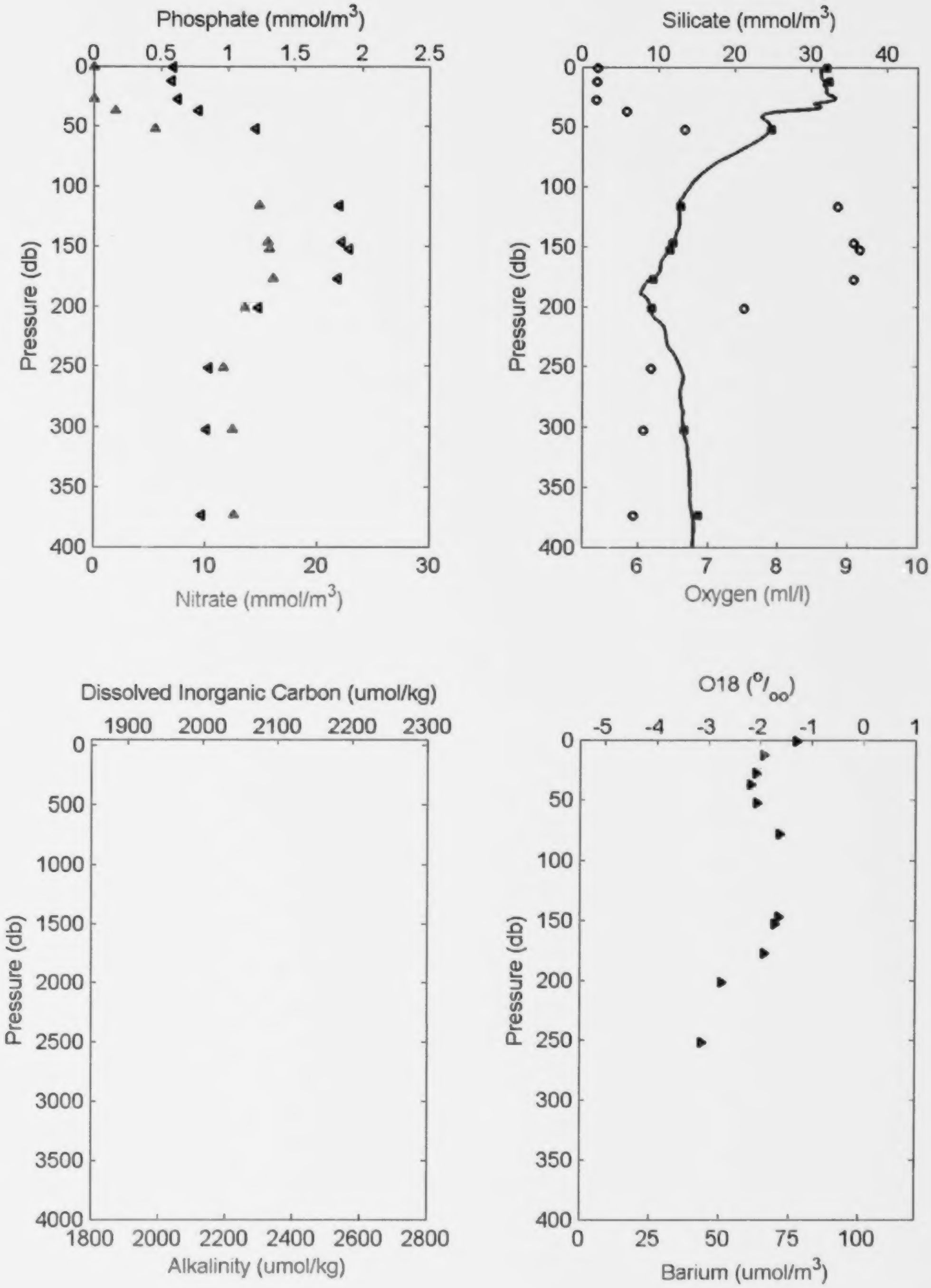
2003-21: Cast 26 Station LS23



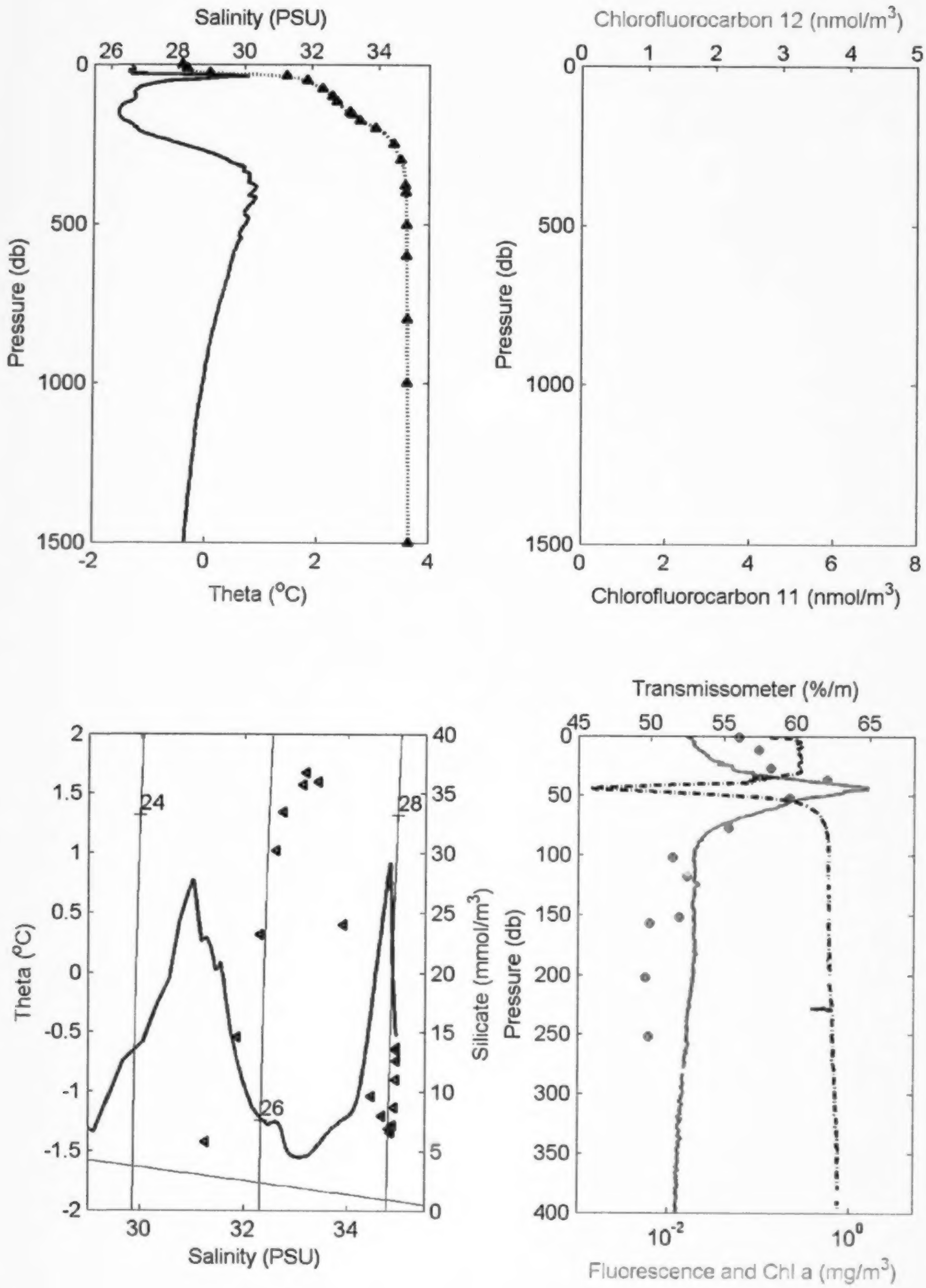
2003-21: Cast 27 Station LS24



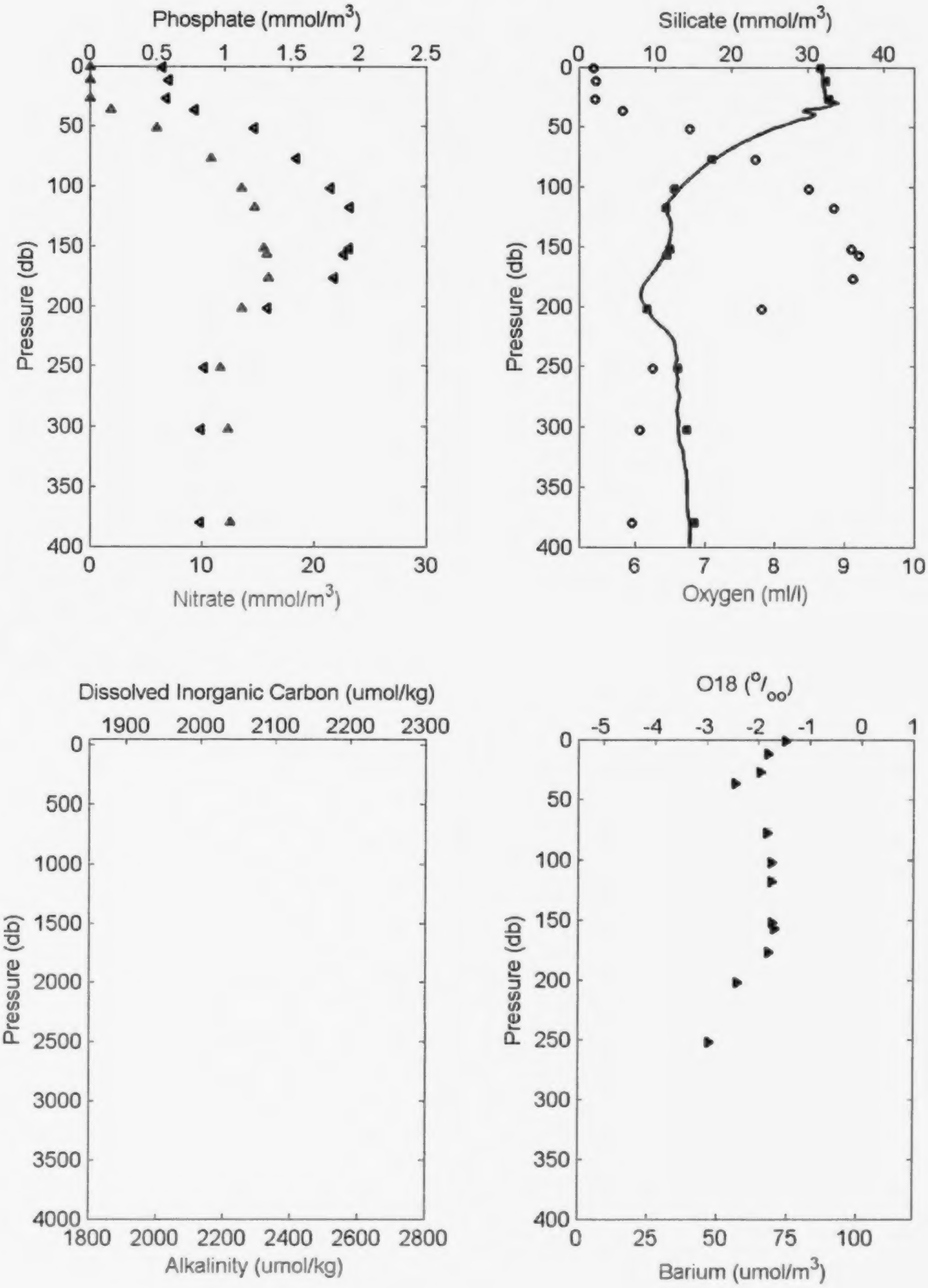
2003-21: Cast 27 Station LS24



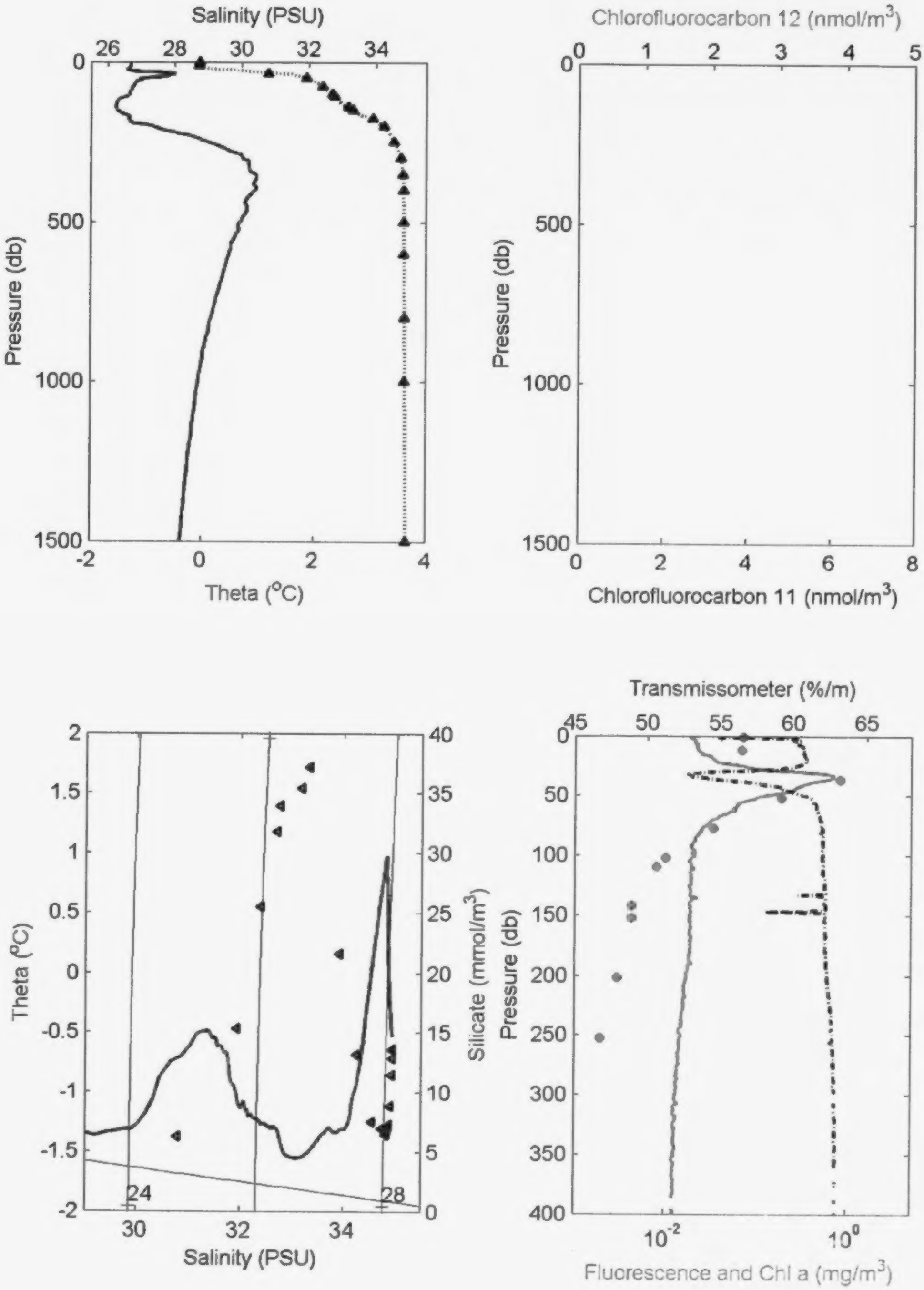
2003-21: Cast 28 Station LS25



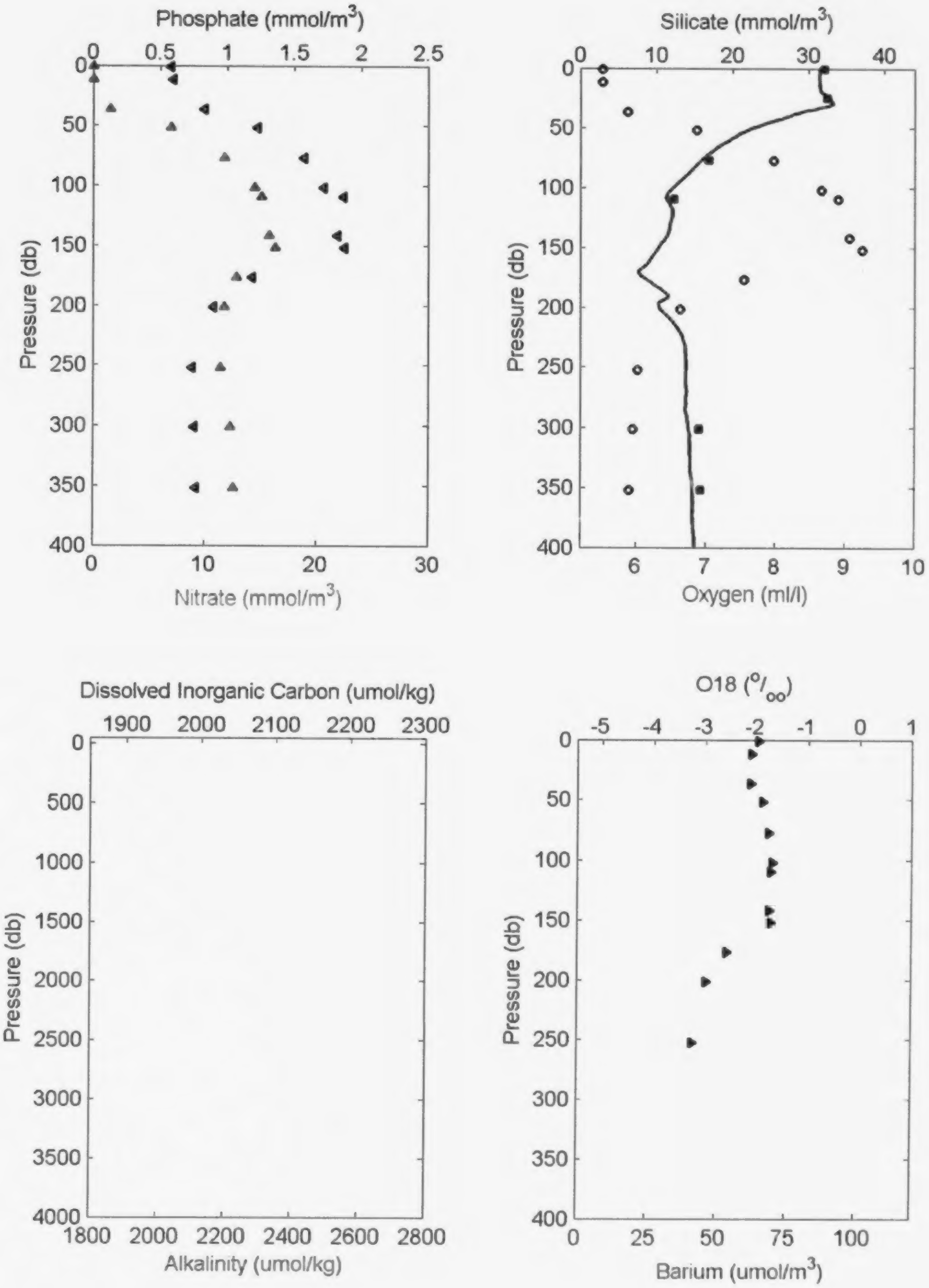
2003-21: Cast 28 Station LS25



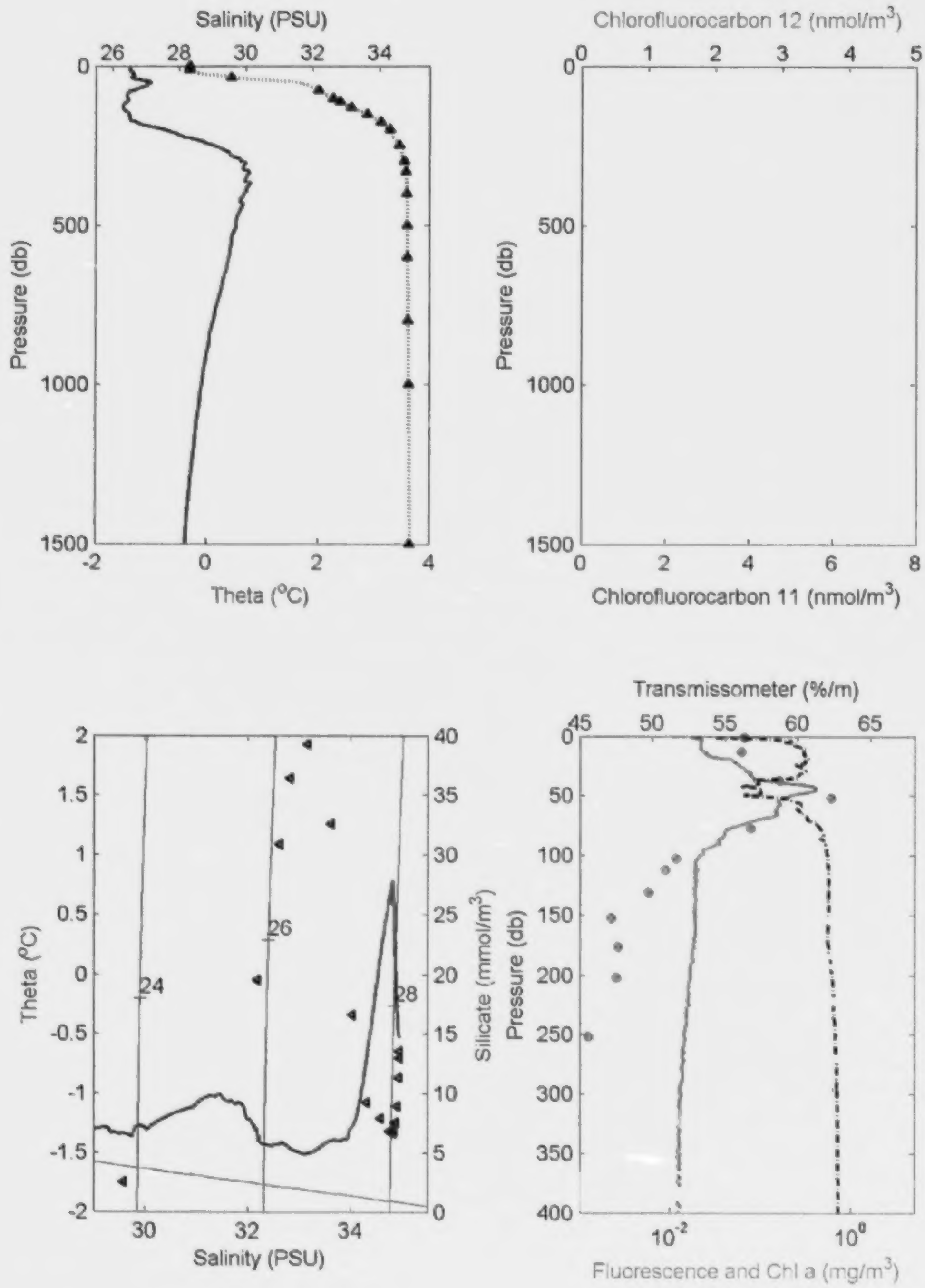
2003-21: Cast 29 Station LS26



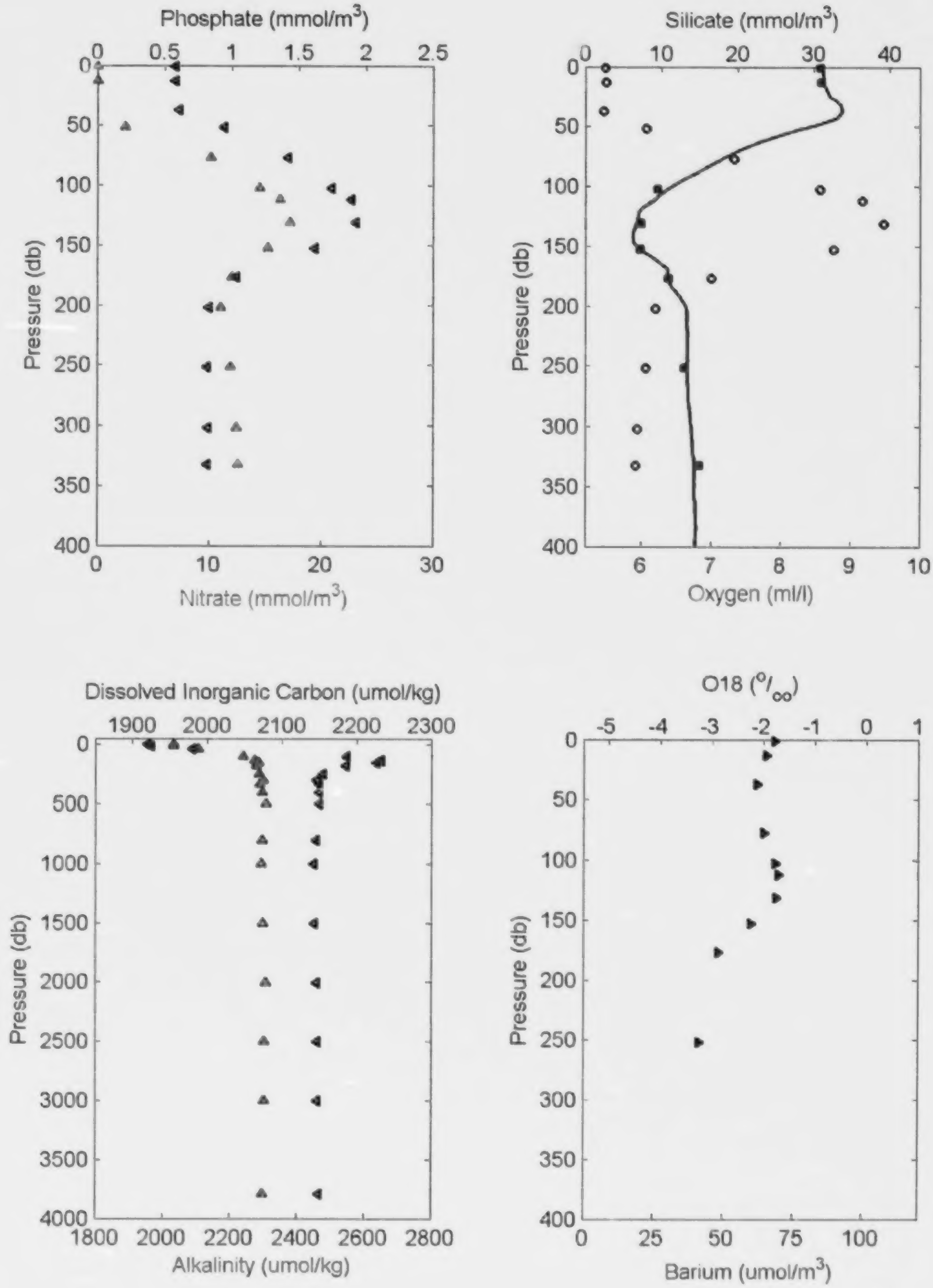
2003-21: Cast 29 Station LS26



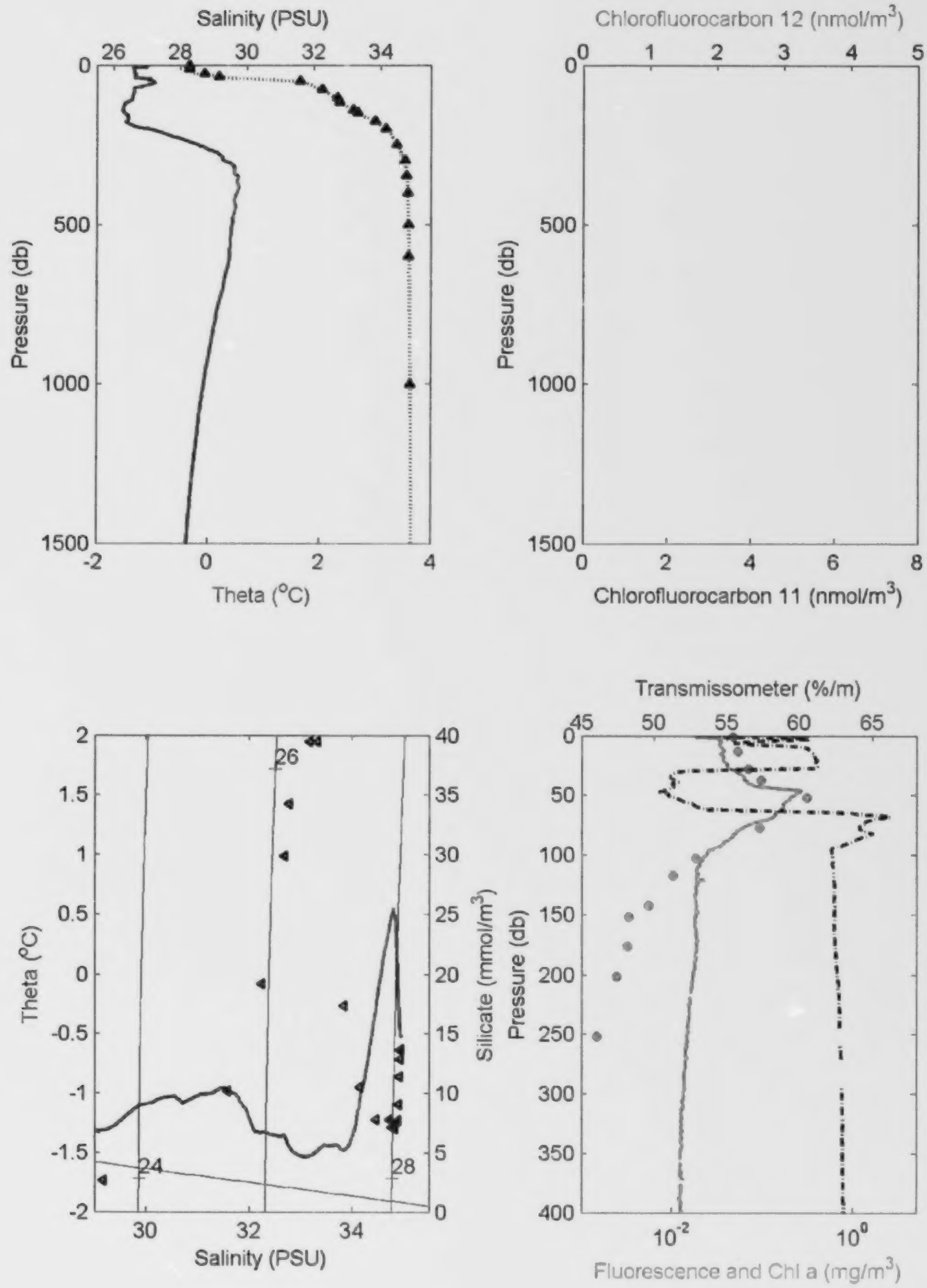
2003-21: Cast 30 Station LS27



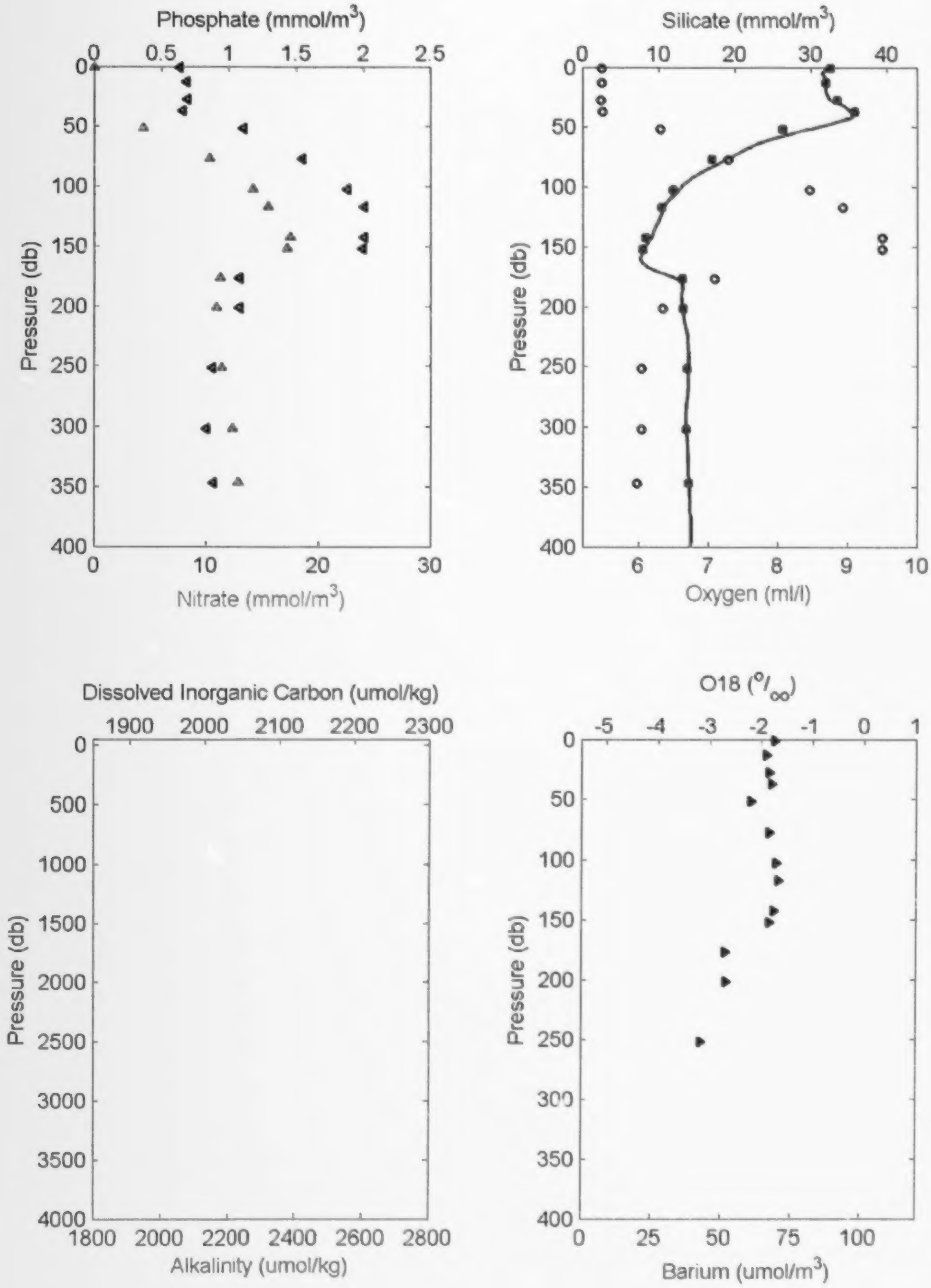
2003-21: Cast 30 Station LS27



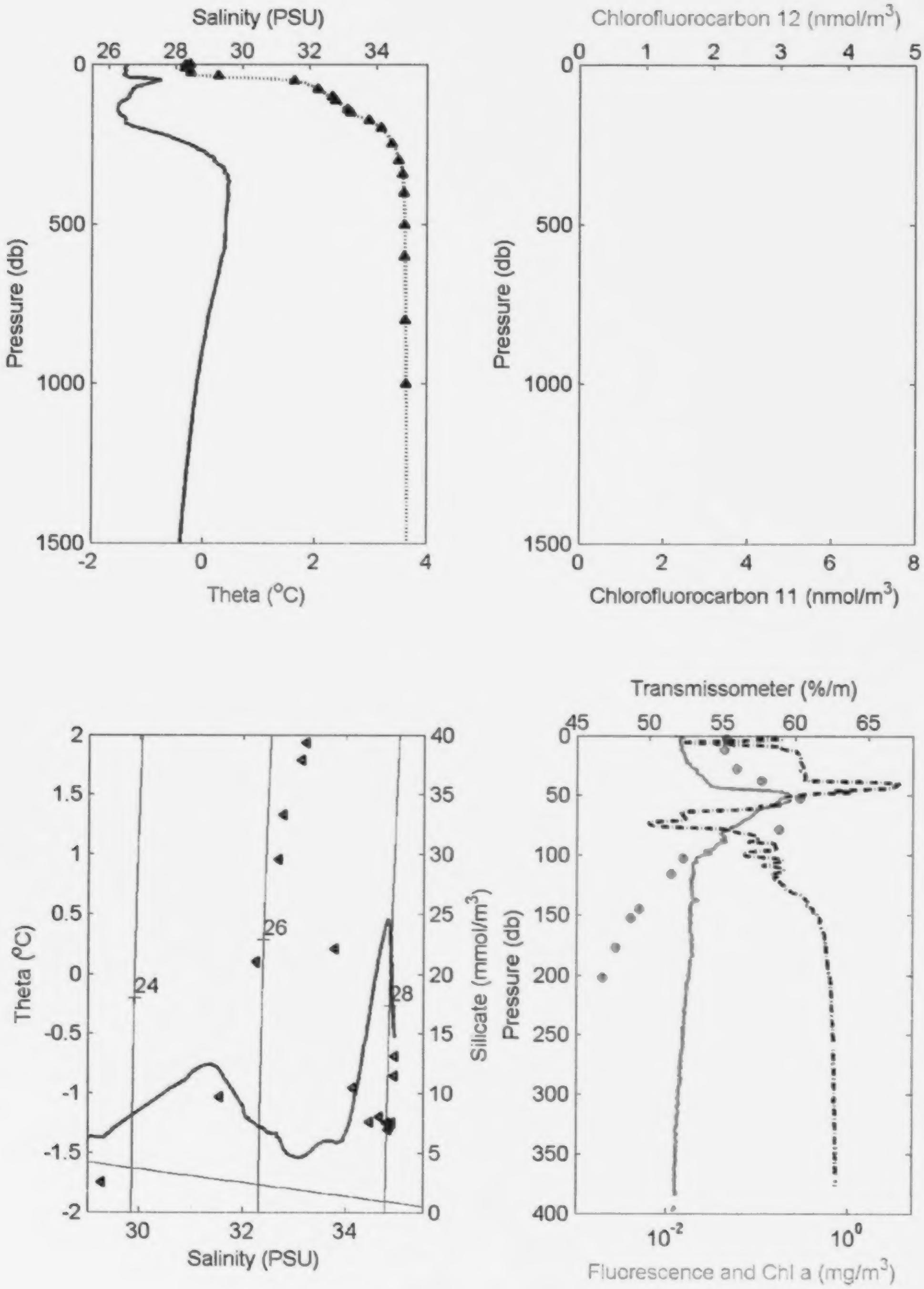
2003-21: Cast 31 Station LS28



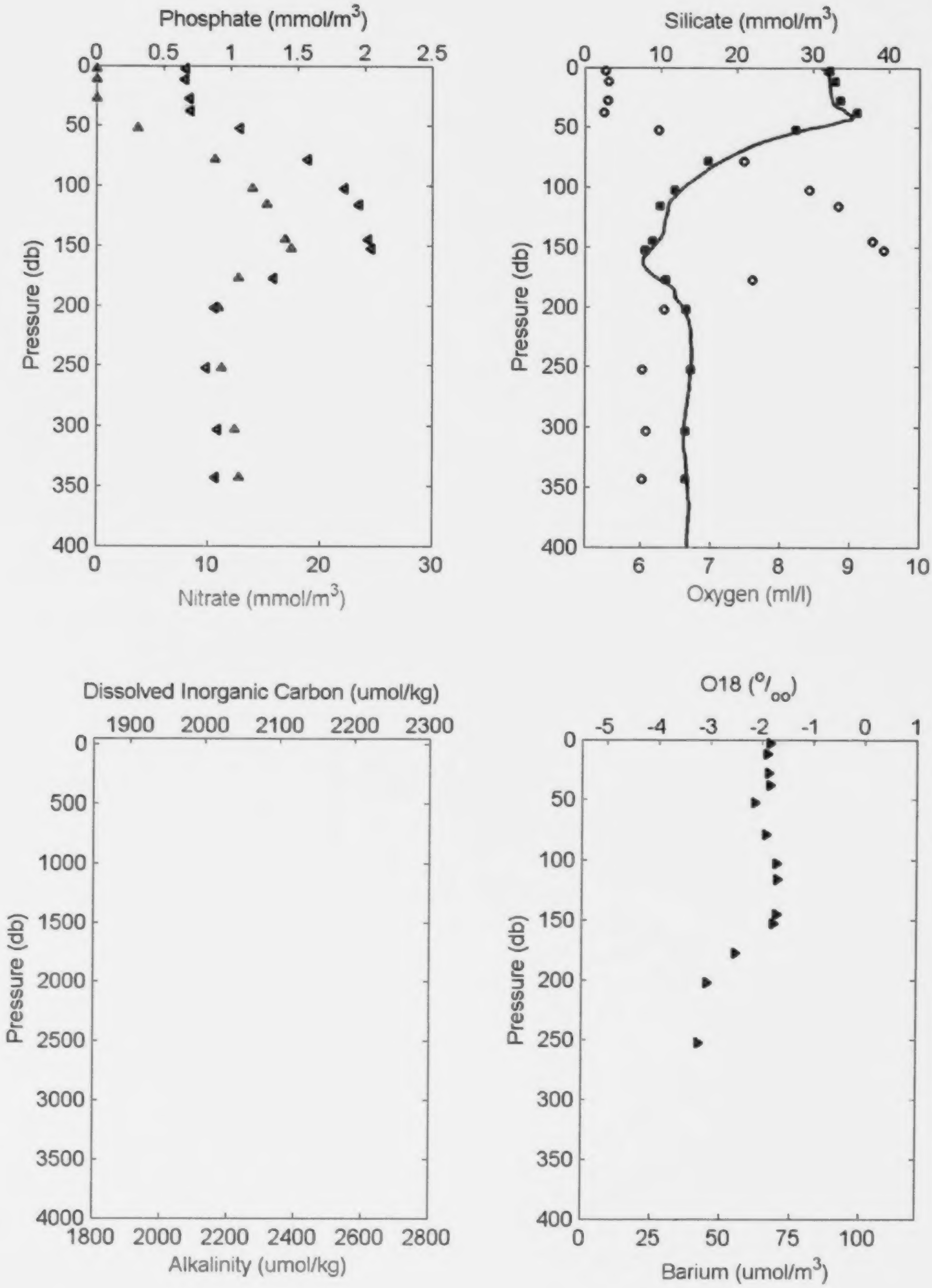
2003-21: Cast 31 Station LS28



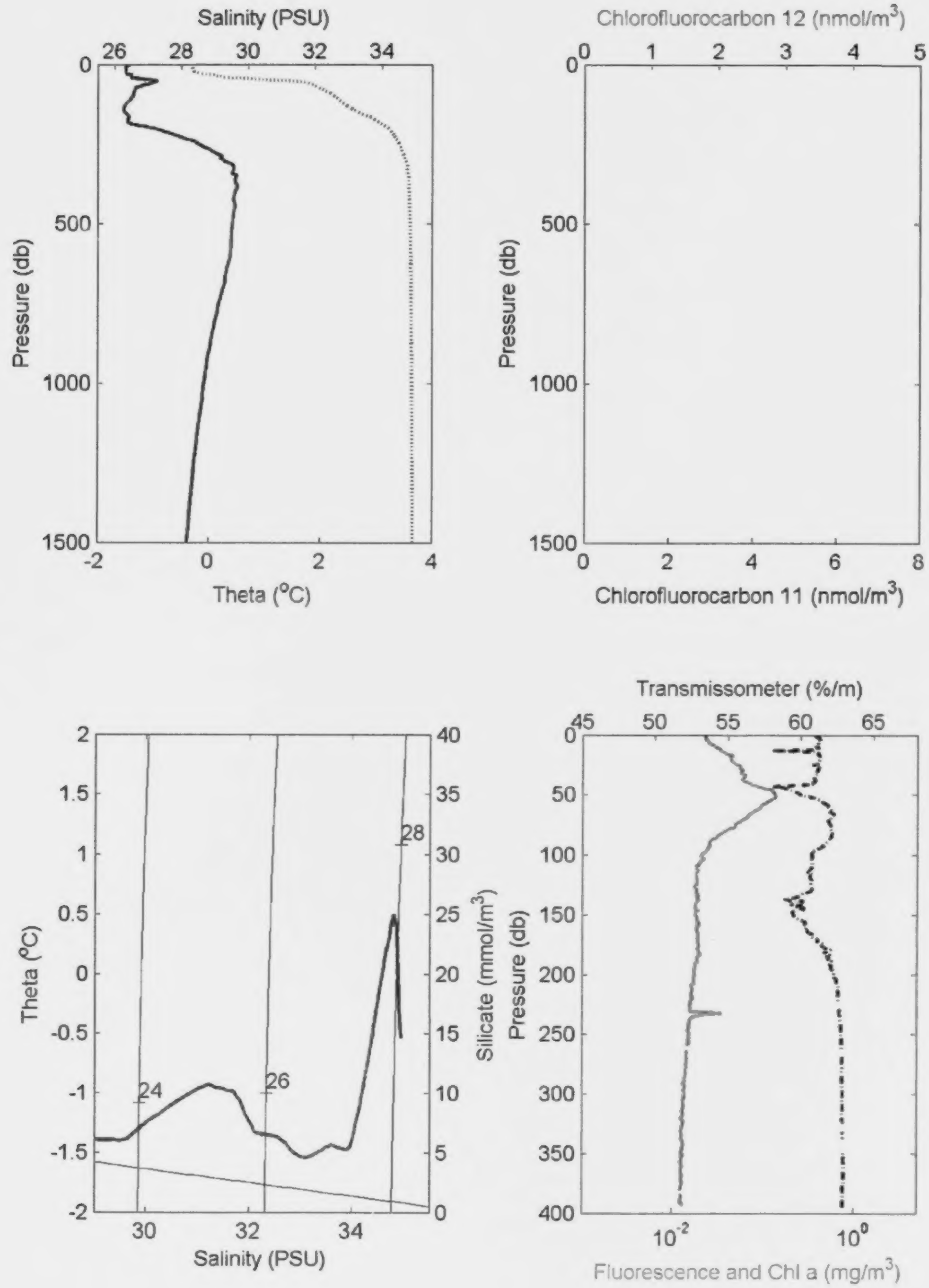
2003-21: Cast 32 Station LS29



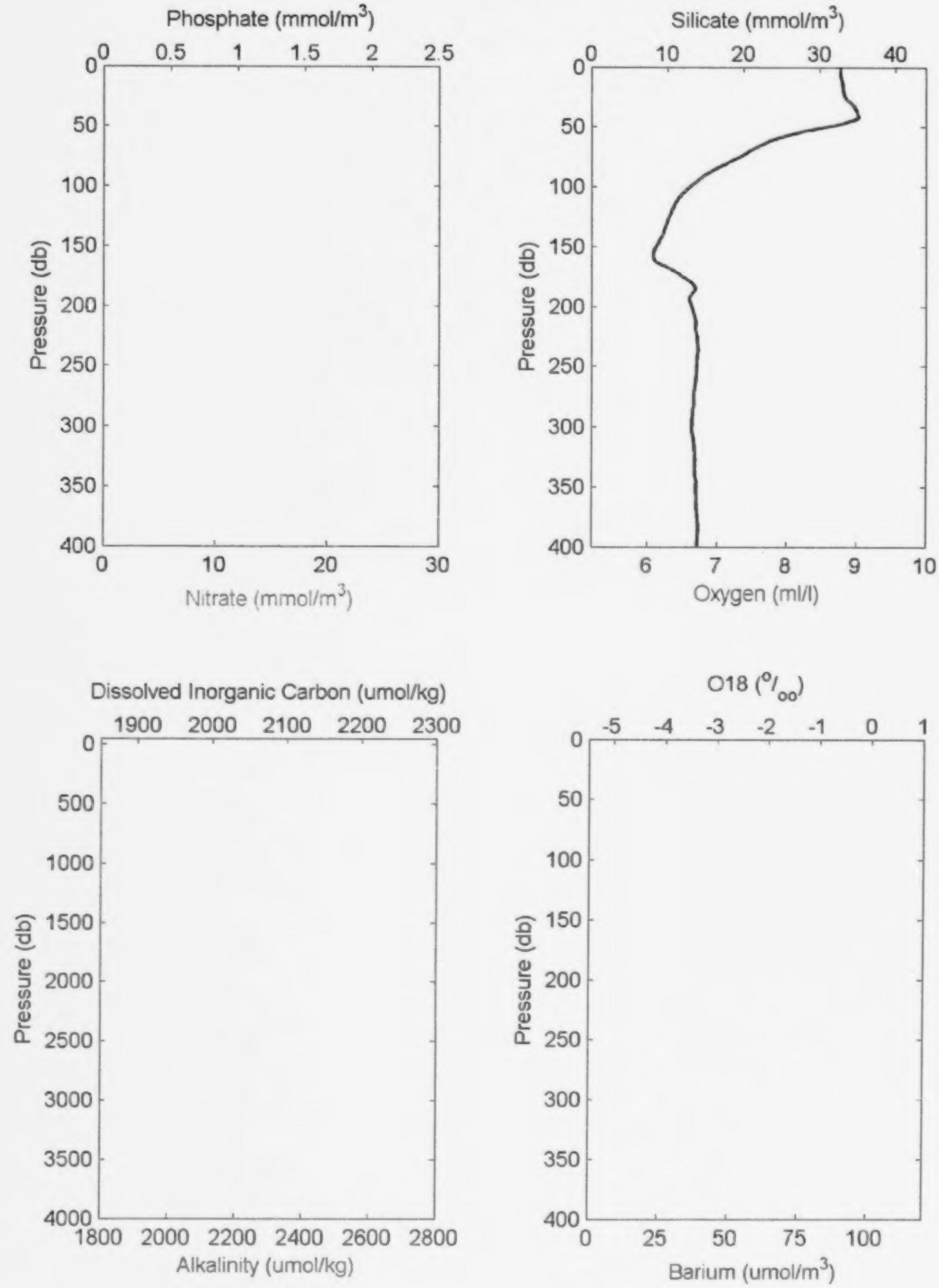
2003-21: Cast 32 Station LS29



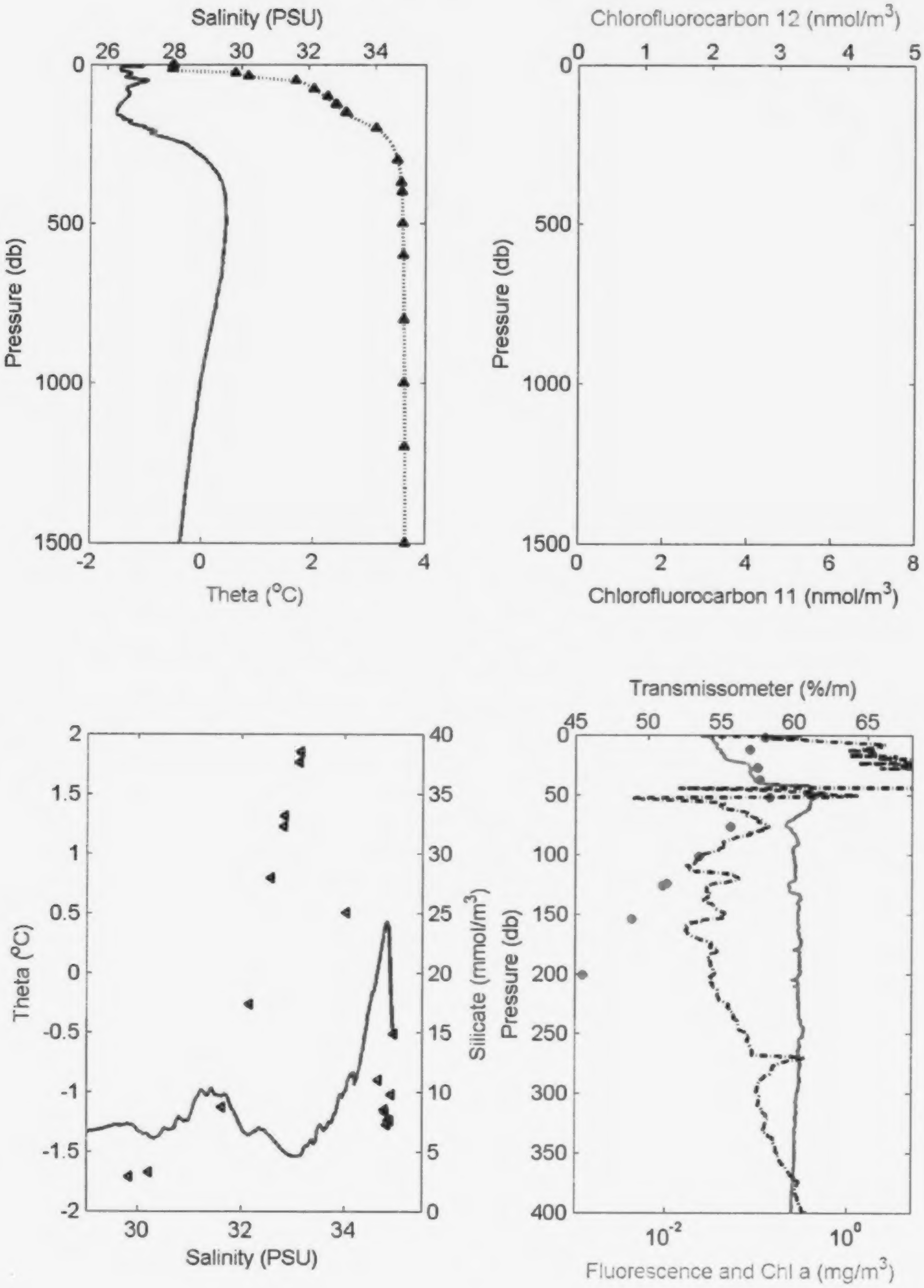
2003-21: Cast 33 Station LS30



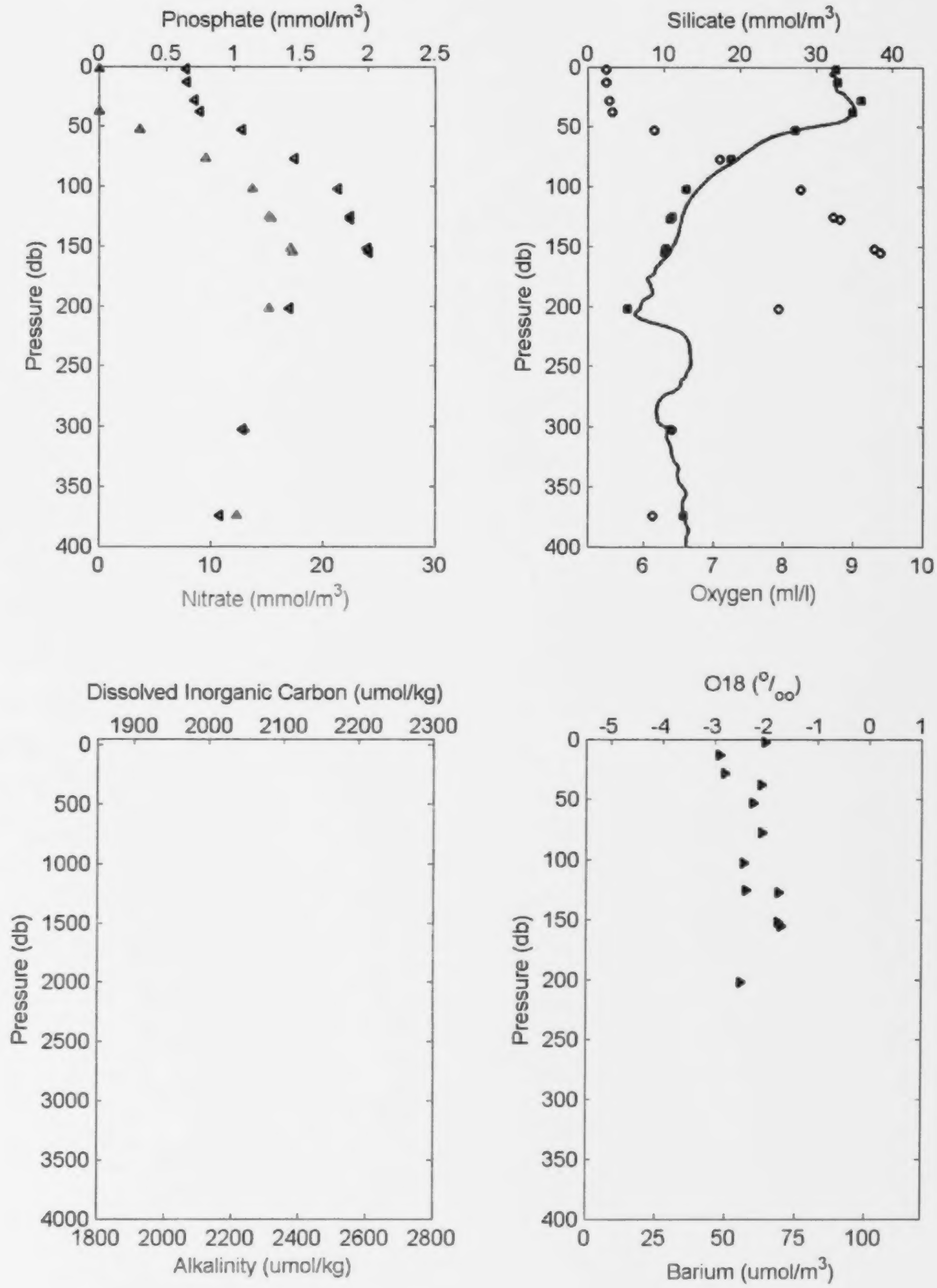
2003-21: Cast 33 Station LS30



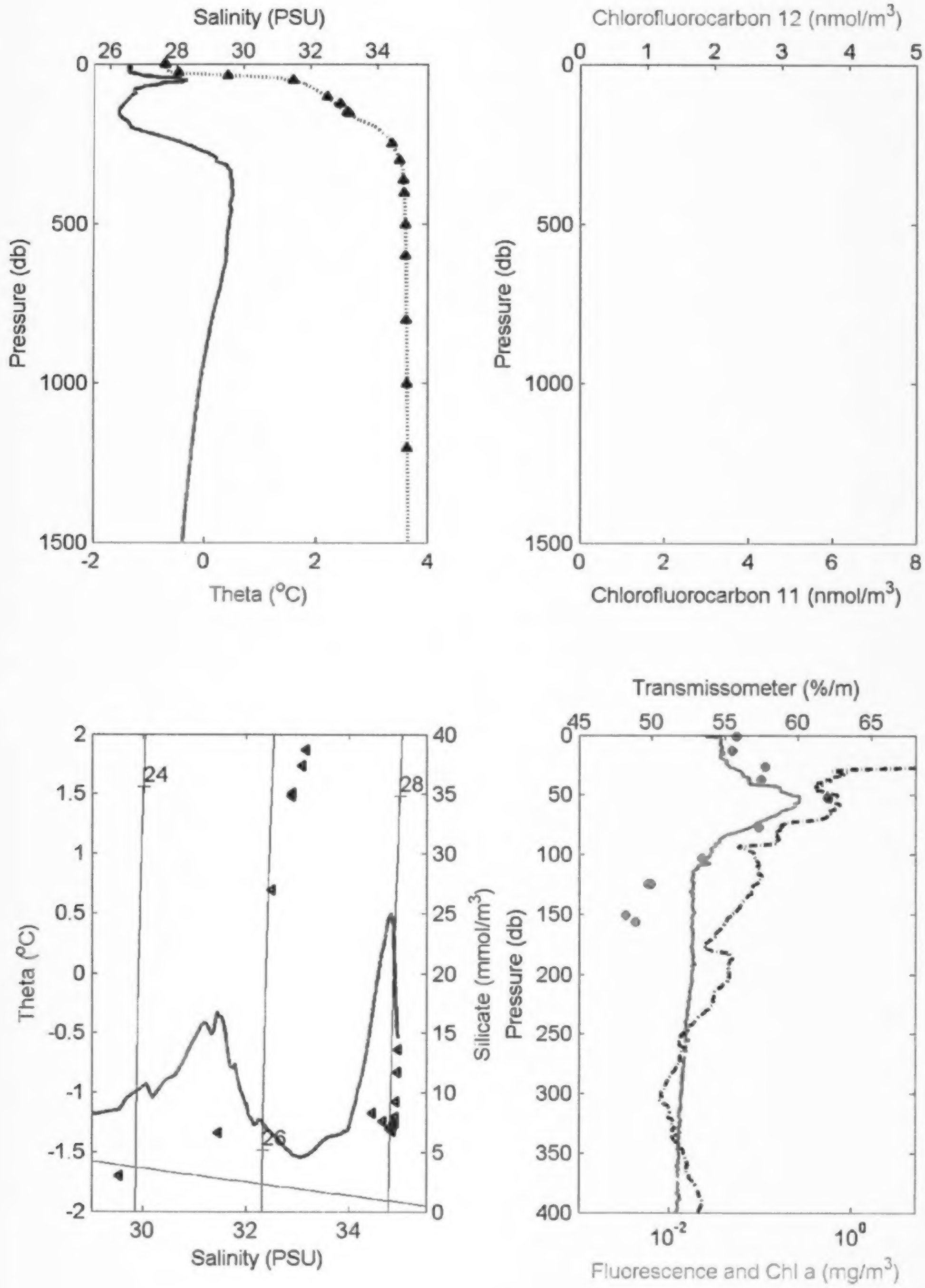
2003-21: Cast 34 Station LS31



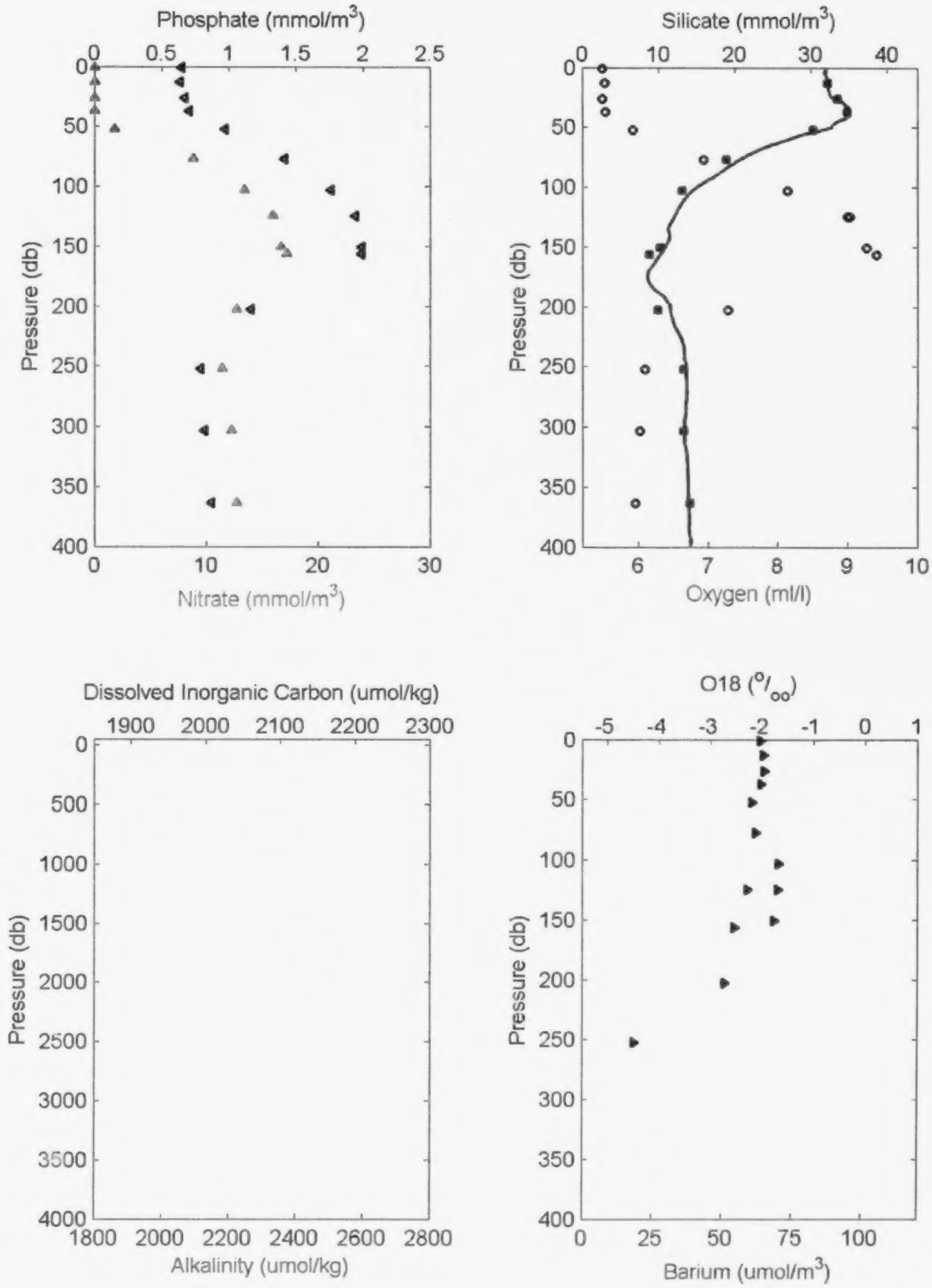
2003-21: Cast 34 Station LS31



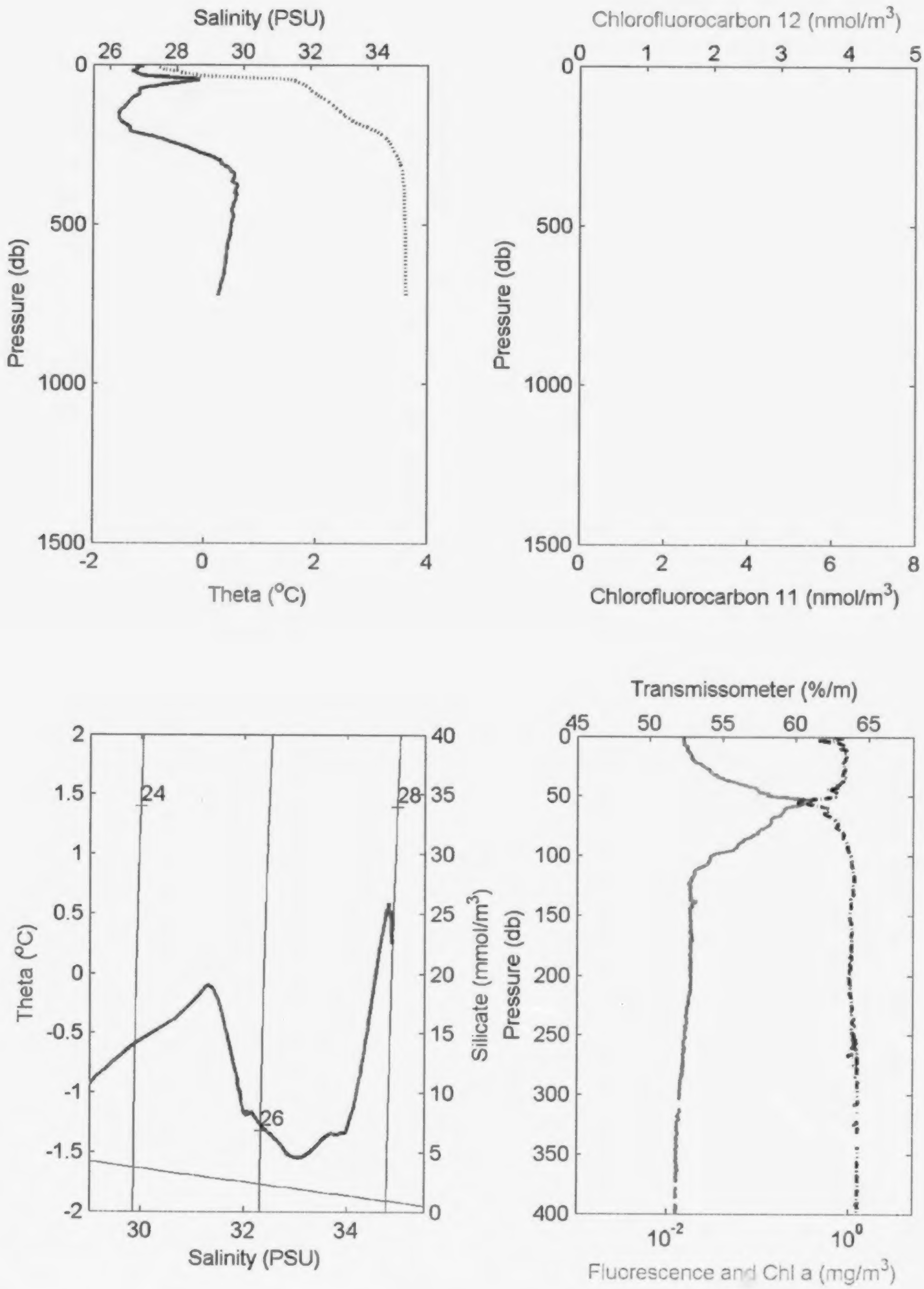
2003-21: Cast 35 Station LS32



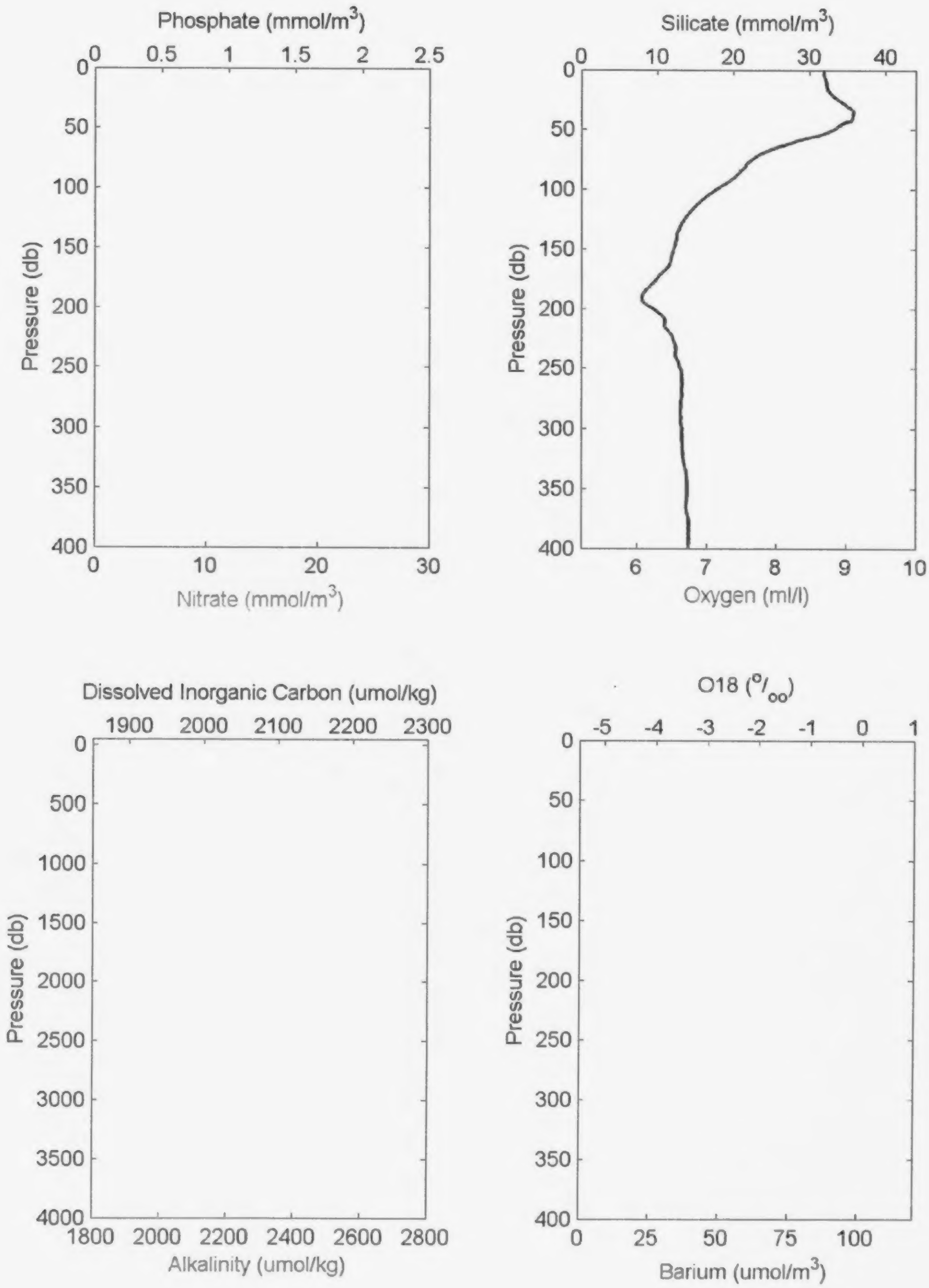
2003-21: Cast 35 Station LS32



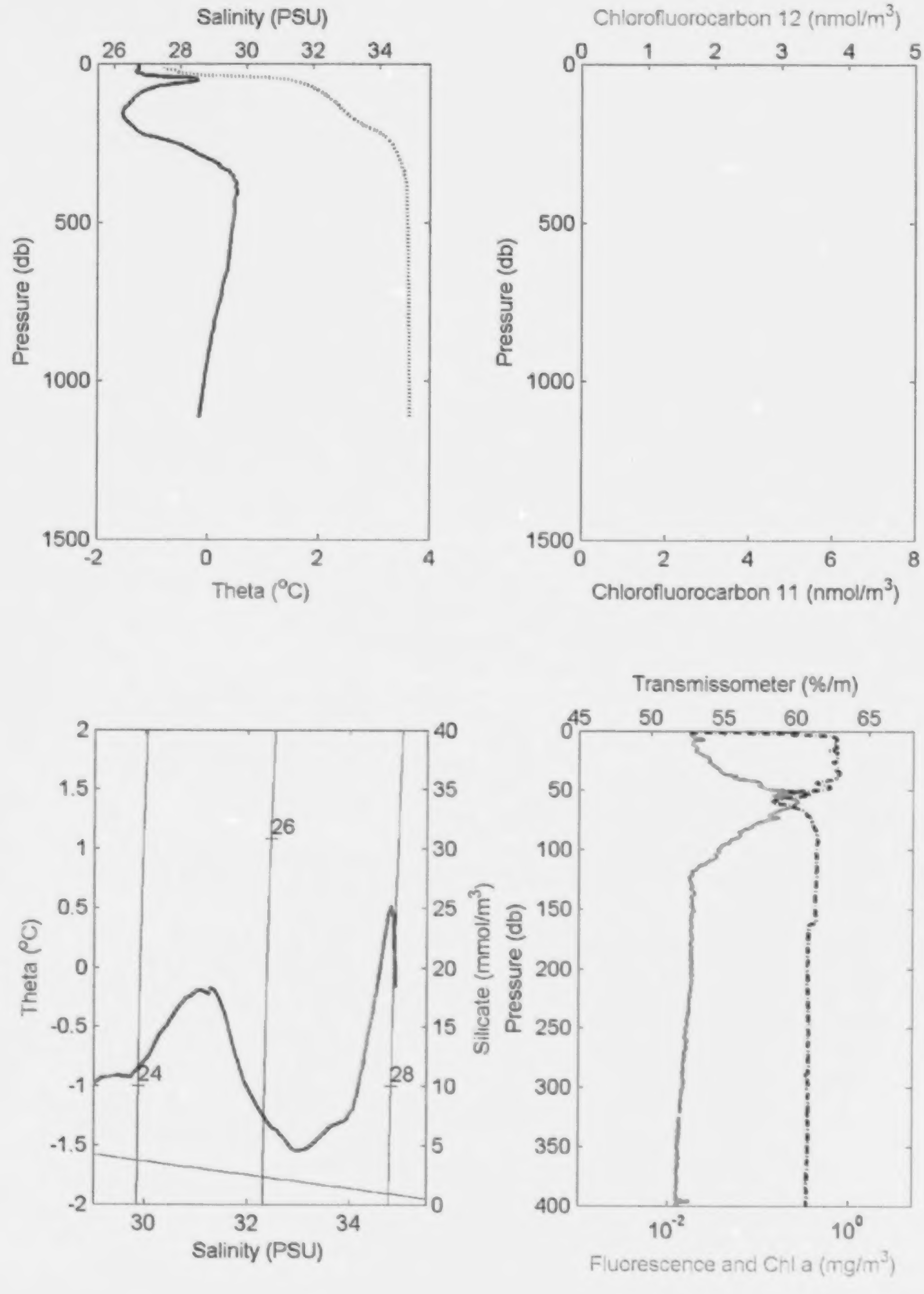
2003-21: Cast 36 Station LS33-t1



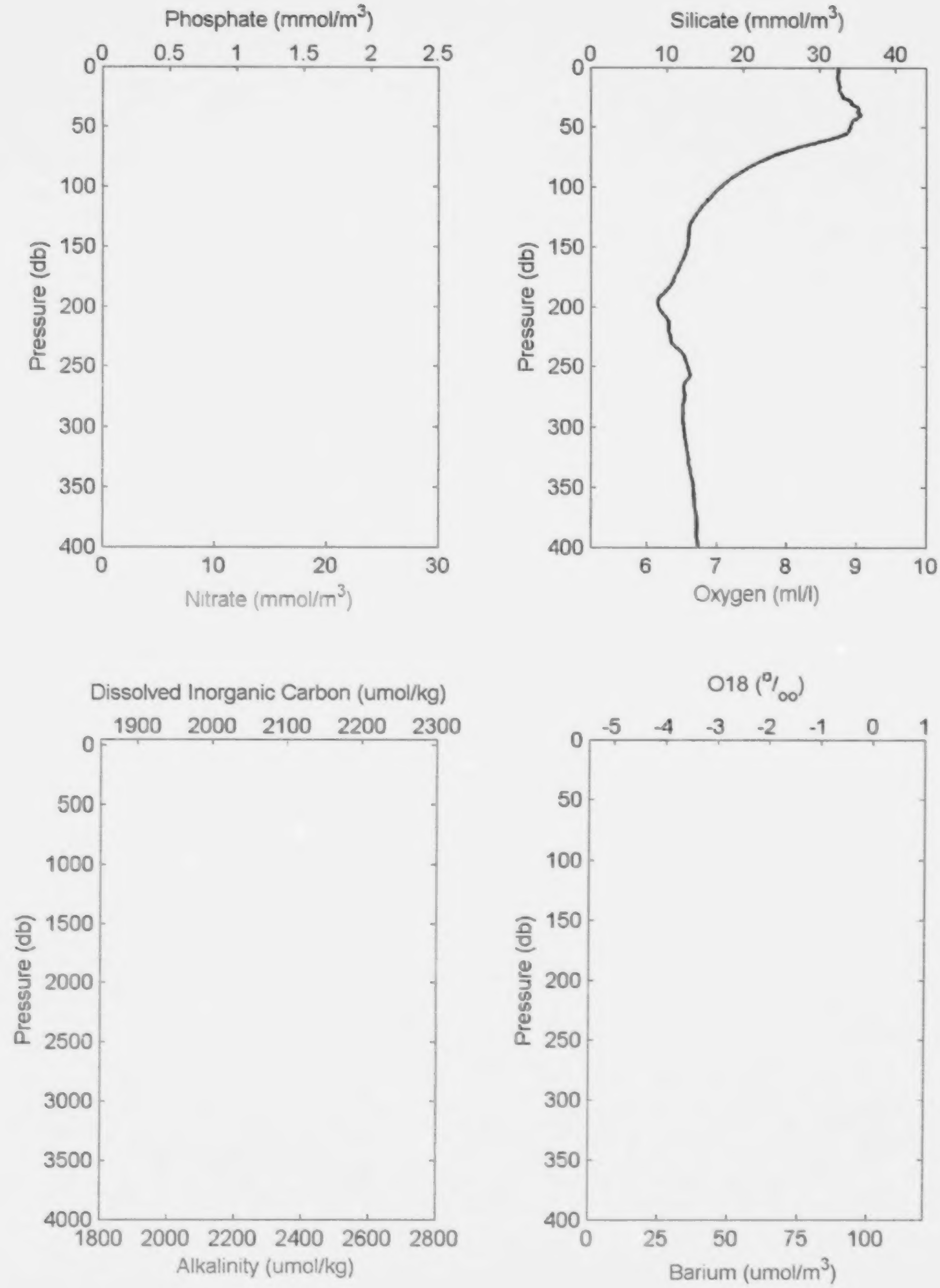
2003-21: Cast 36 Station LS33-t1



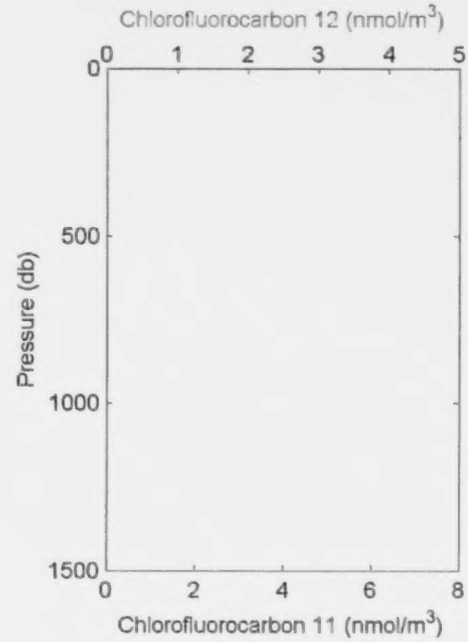
2003-21: Cast 37 Station LS33-t2

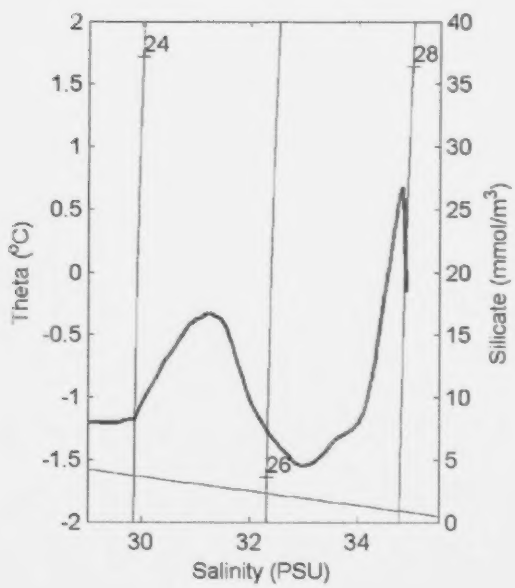


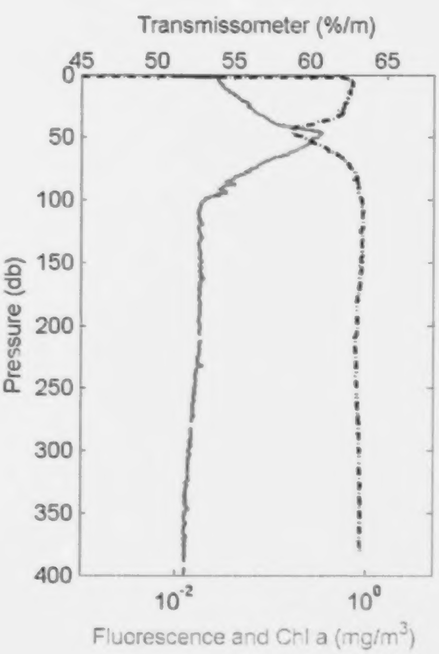
2003-21: Cast 37 Station LS33-t2



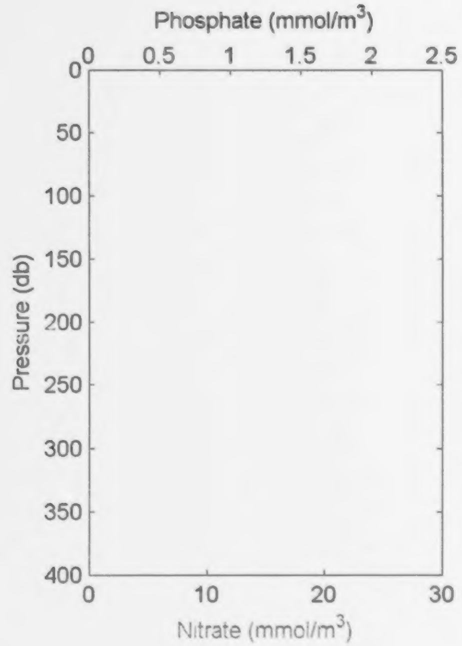
2003-21: Cast 38 Station LS33-t3

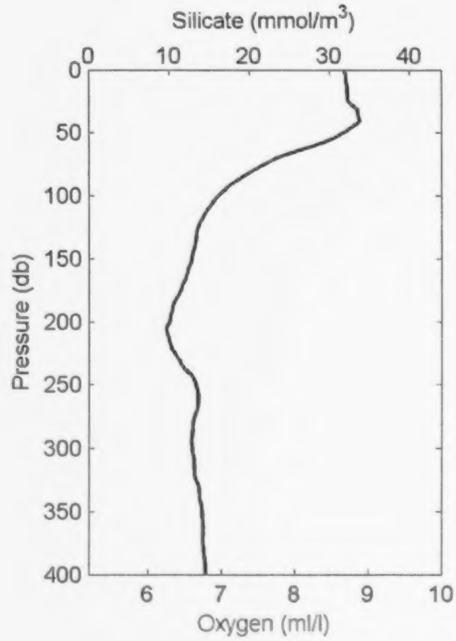


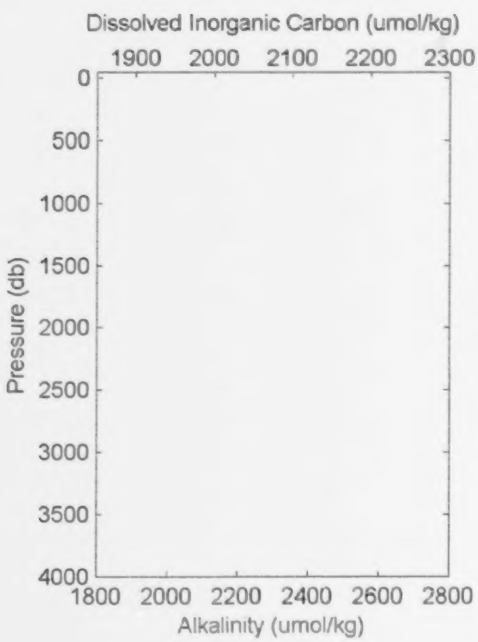


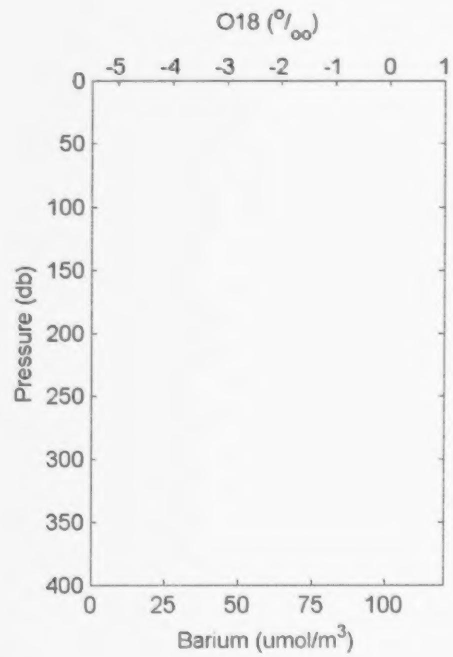


2003-21: Cast 38 Station LS33-t3

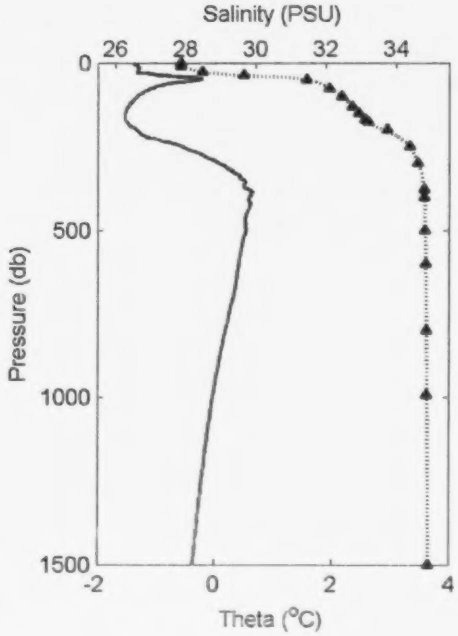


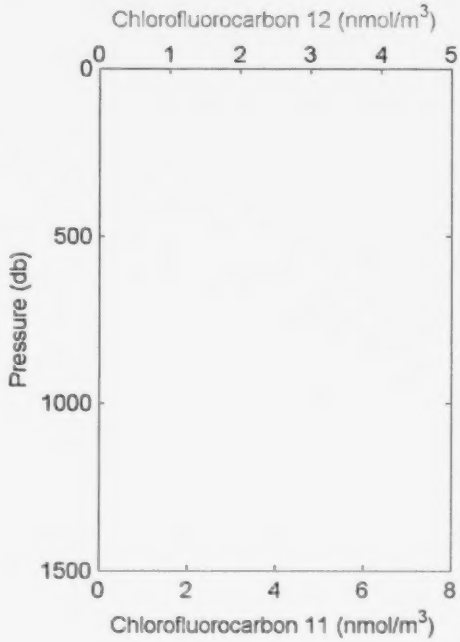


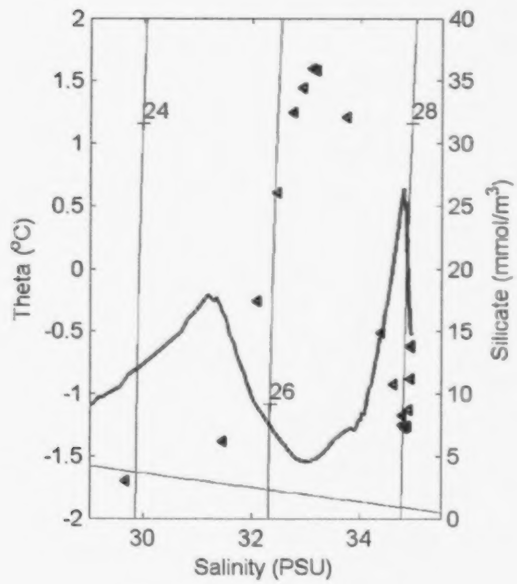


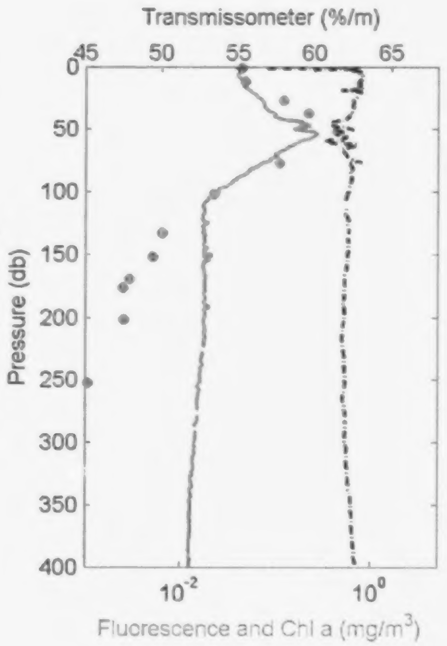


2003-21: Cast 39 Station LS34

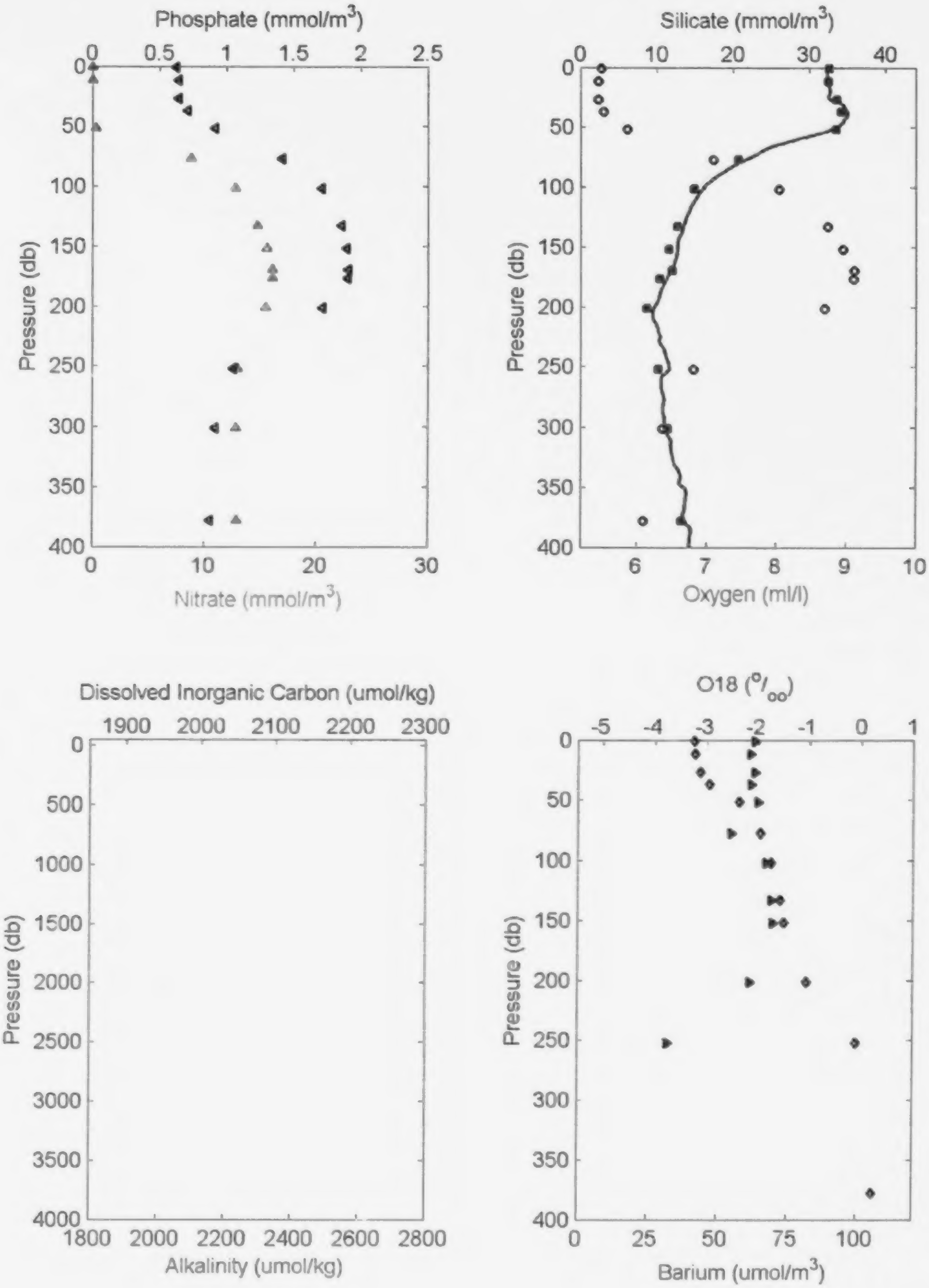




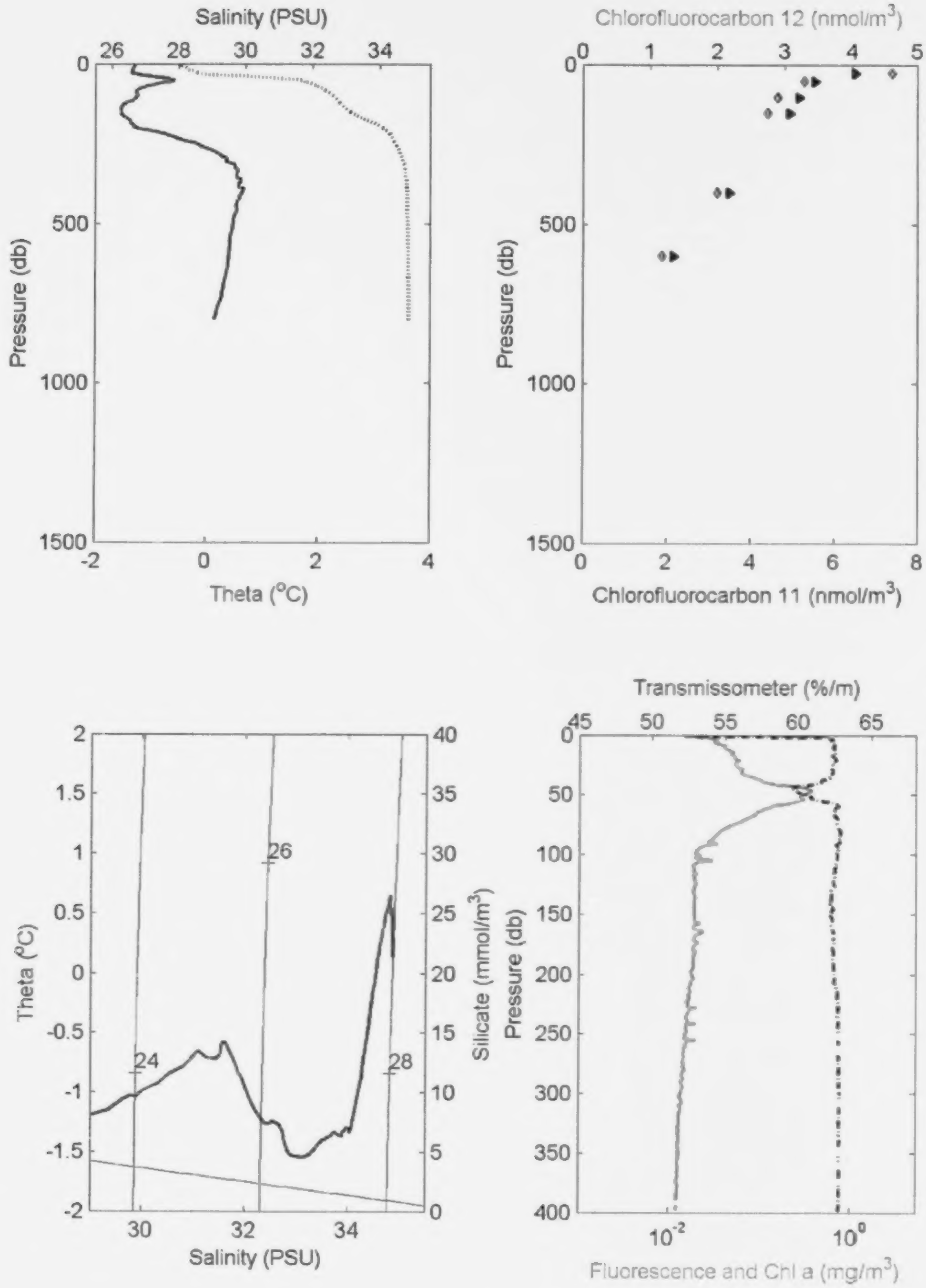




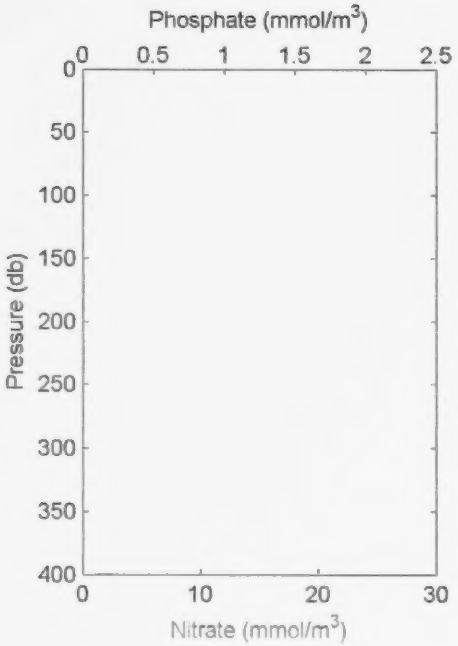
2003-21: Cast 39 Station LS34

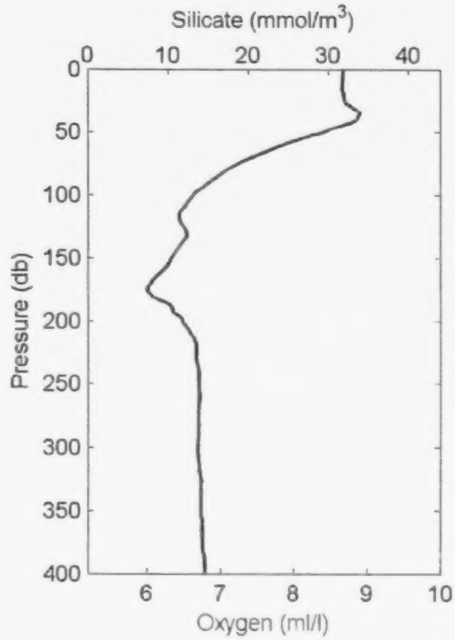


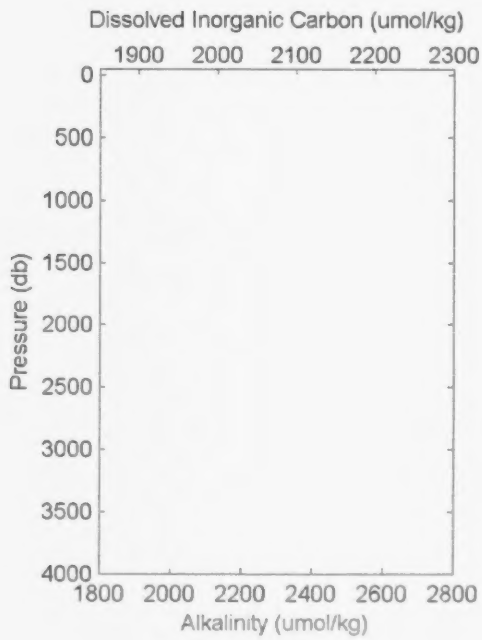
2003-21: Cast 40 Station LS35

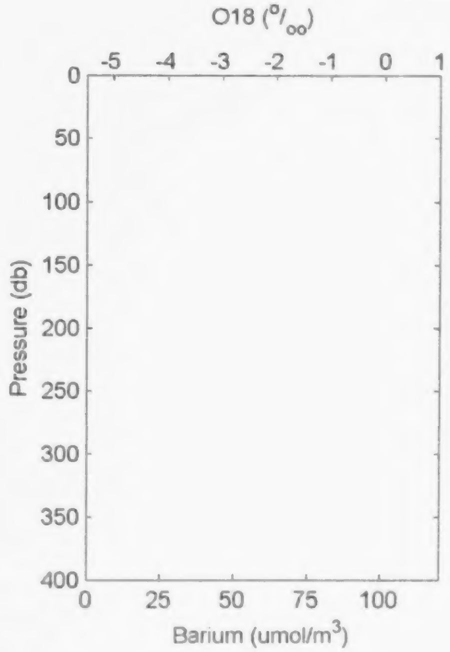


2003-21: Cast 40 Station LS35

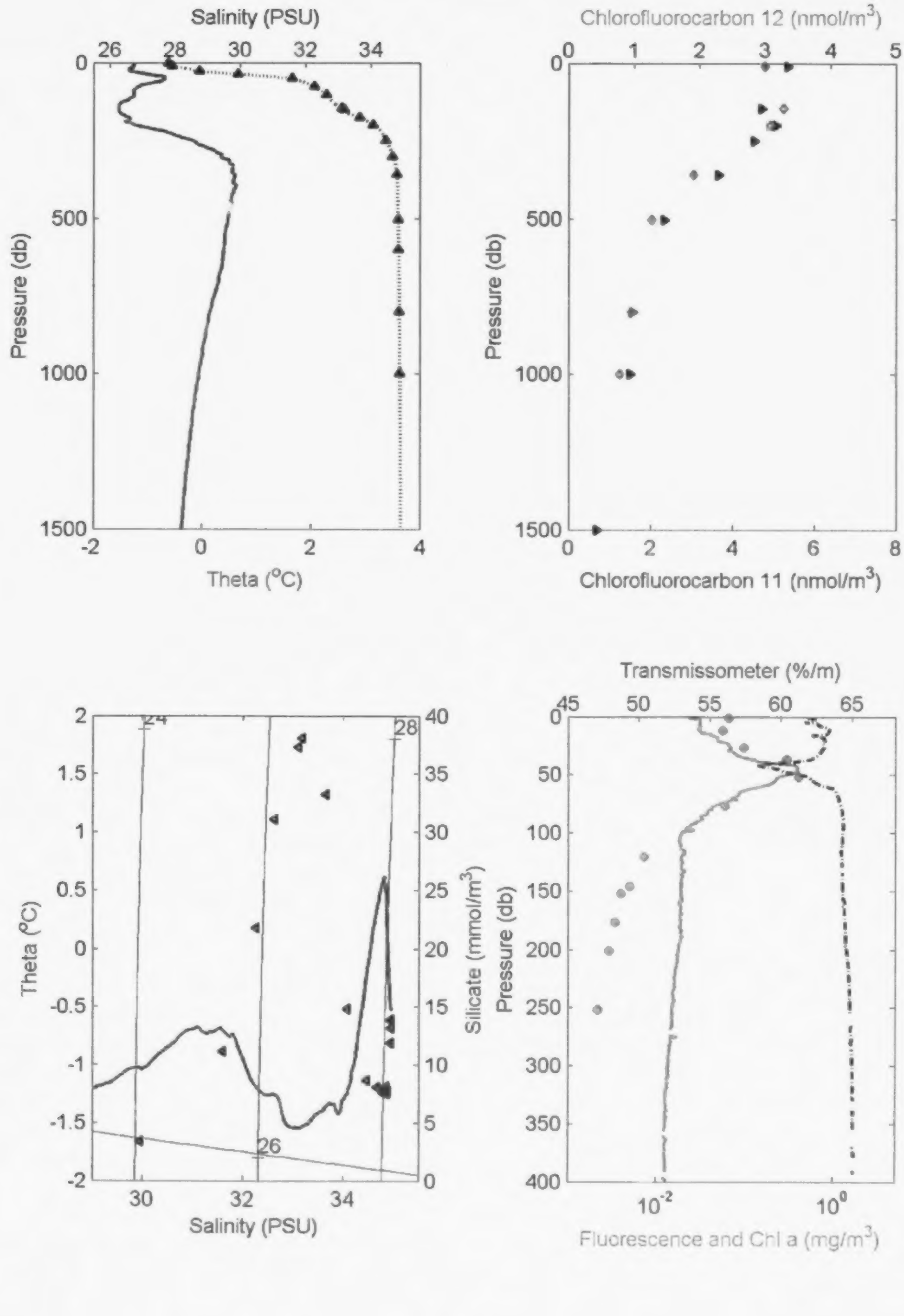




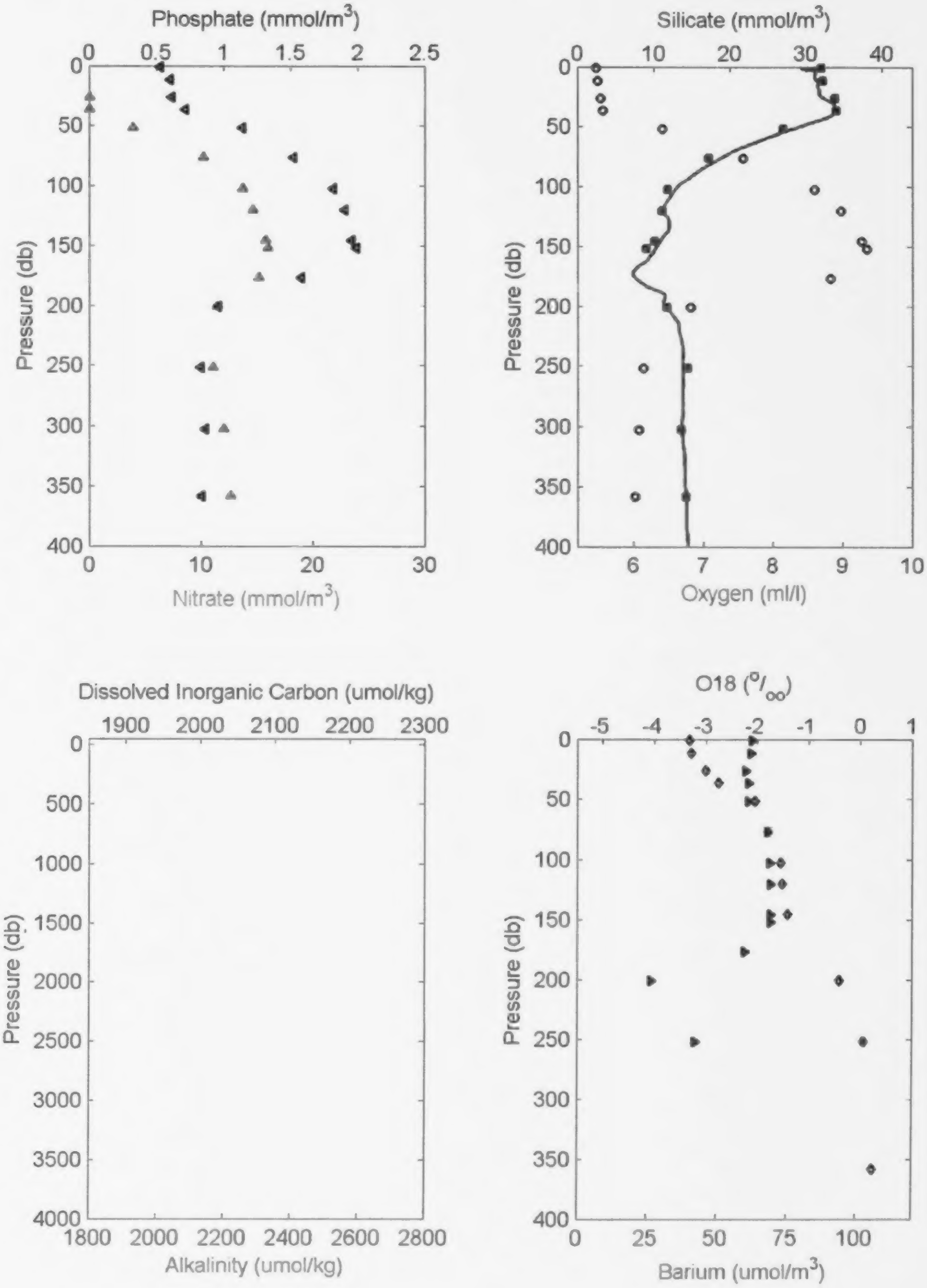




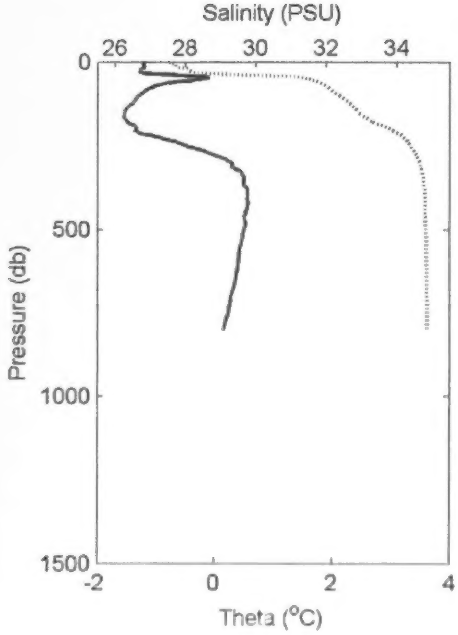
2003-21: Cast 41 Station LS35-2

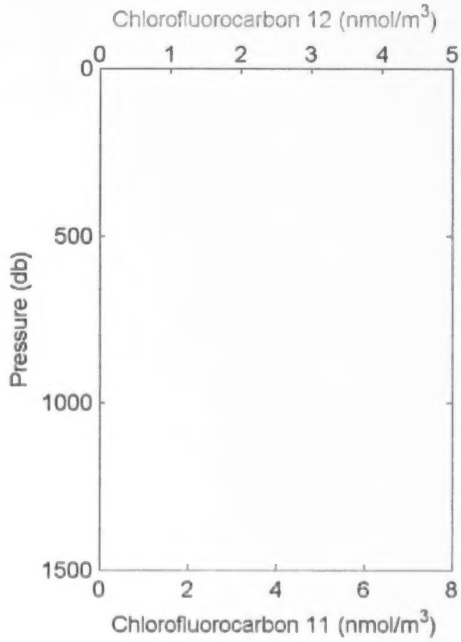


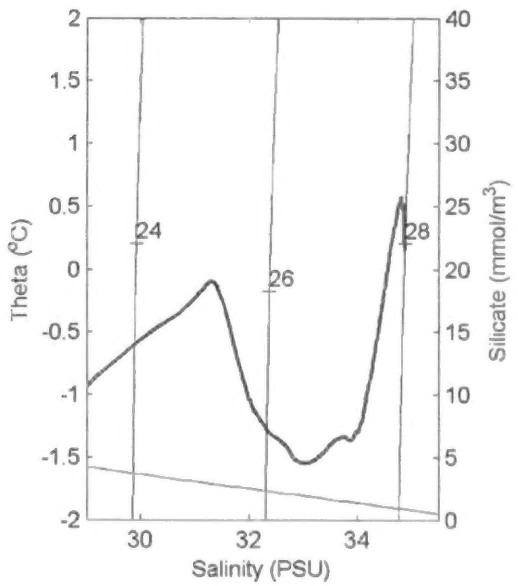
2003-21: Cast 41 Station LS35-2

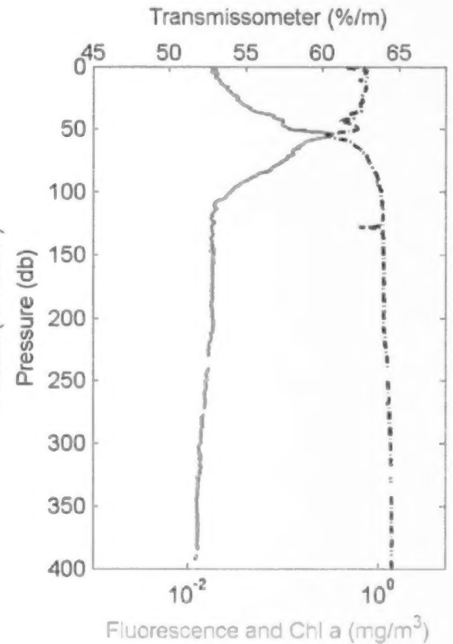


2003-21: Cast 42 Station LS33

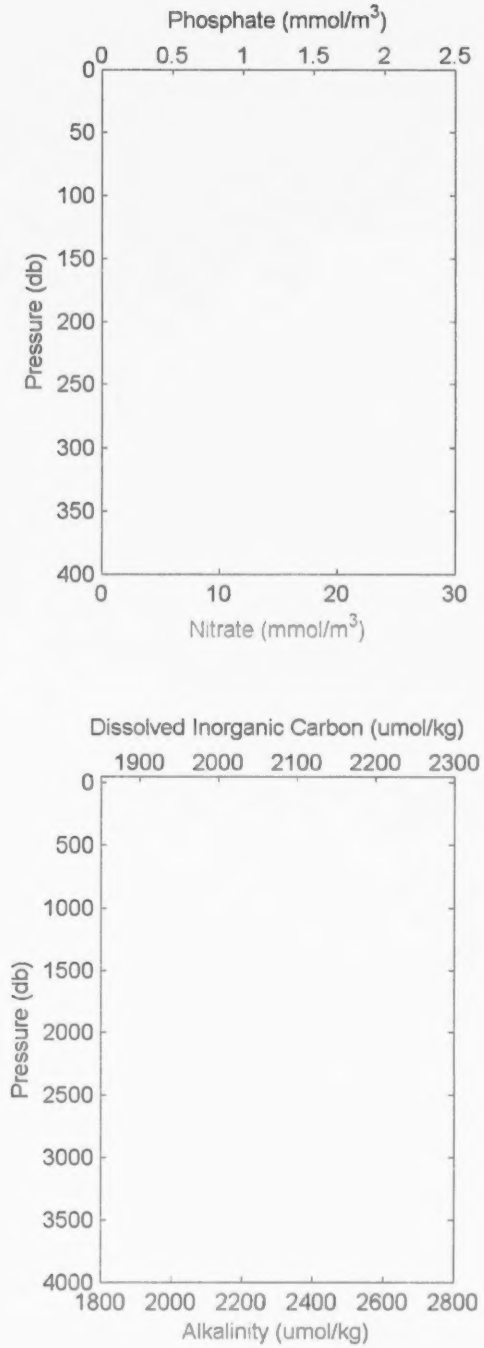




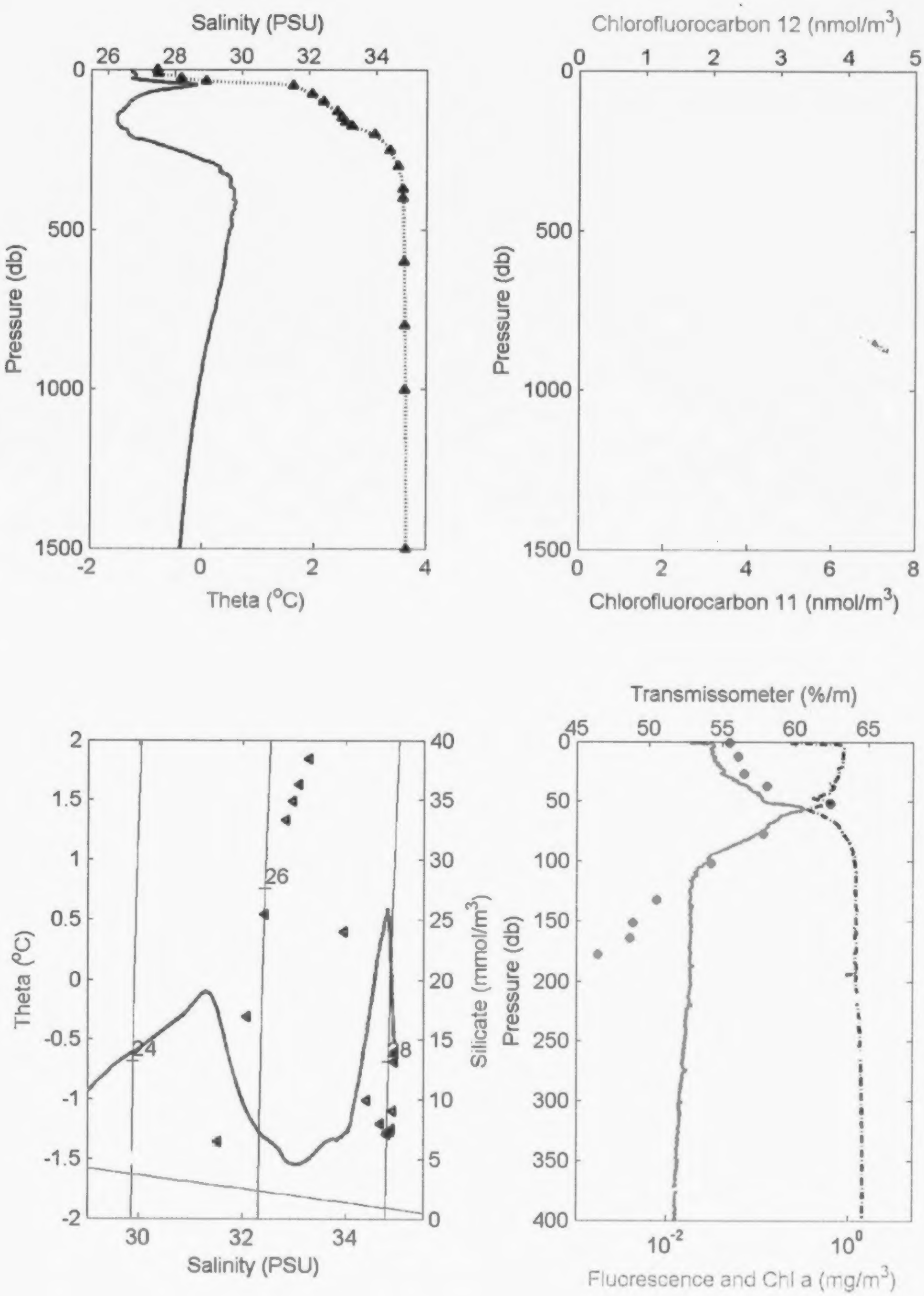




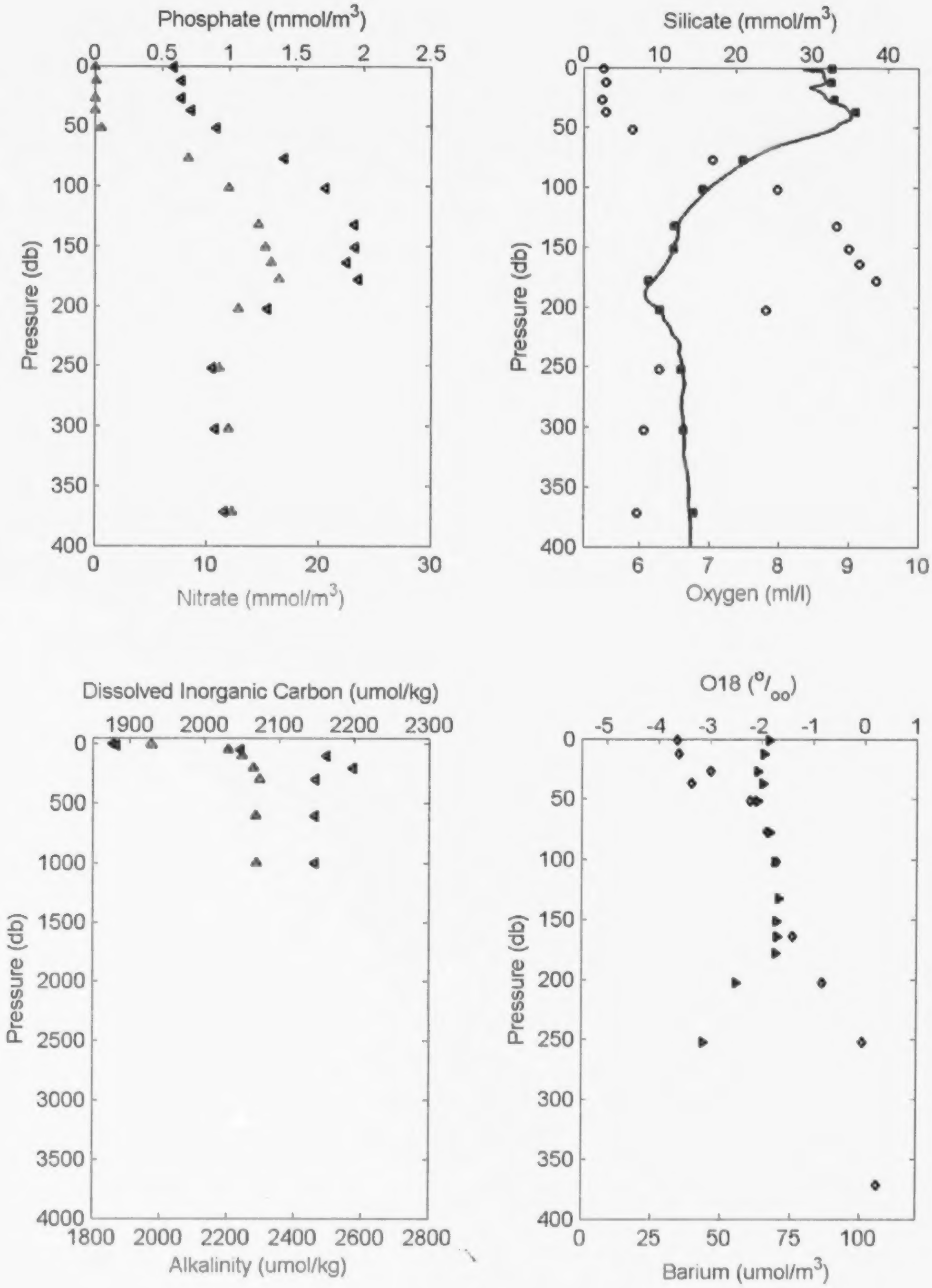
2003-21: Cast 42 Station LS33



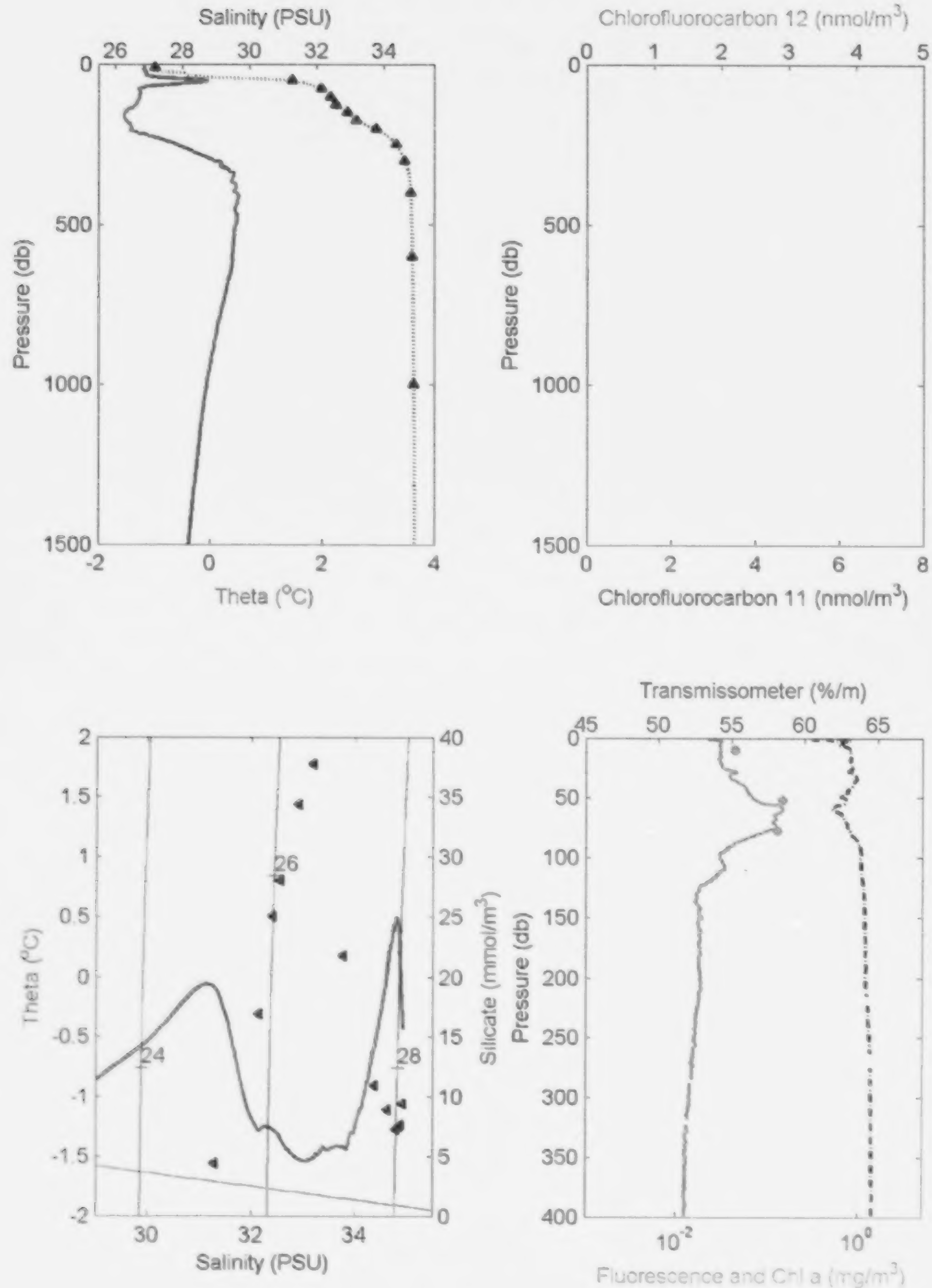
2003-21: Cast 43 Station LS33-2



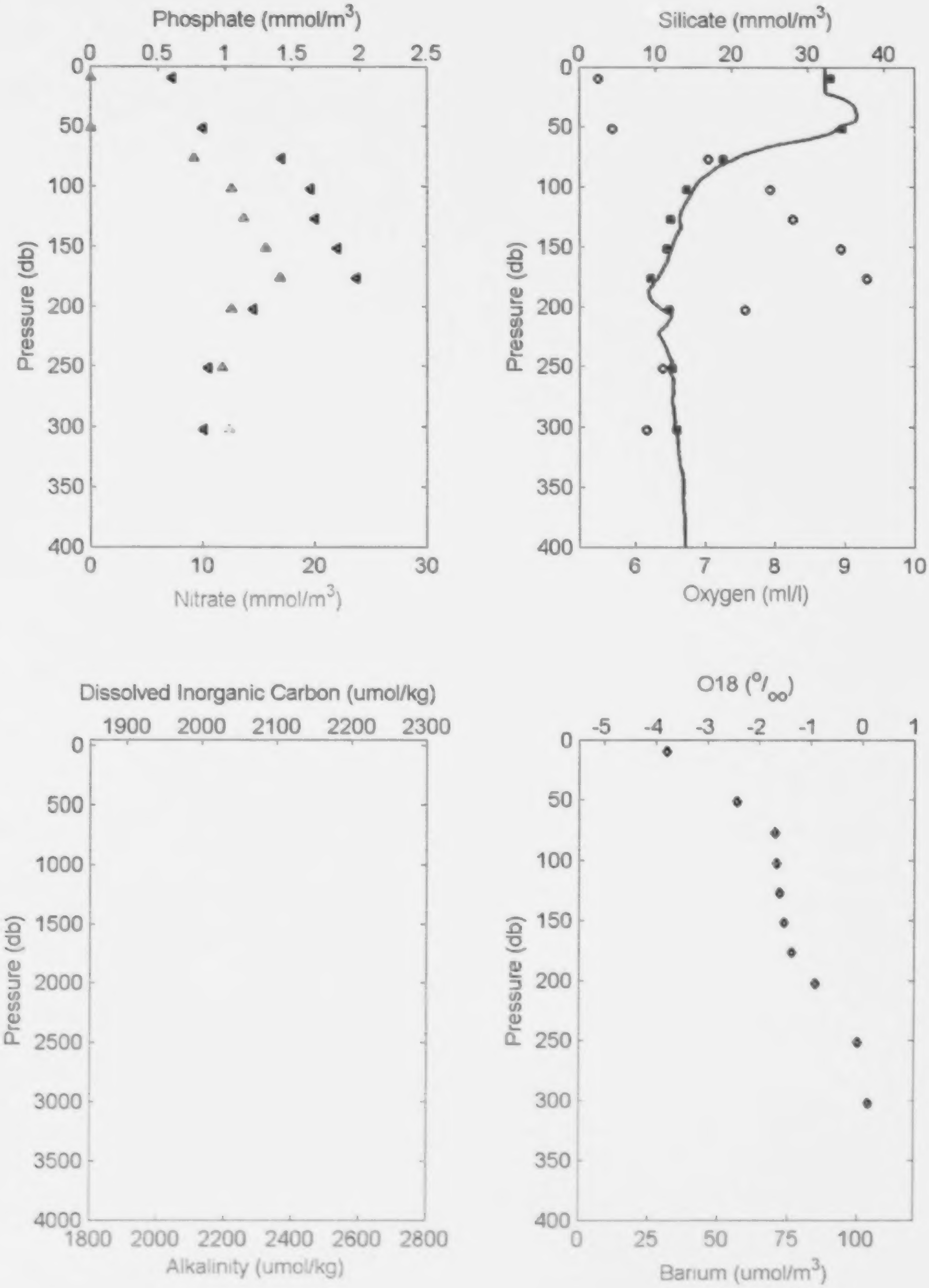
2003-21: Cast 43 Station LS33-2



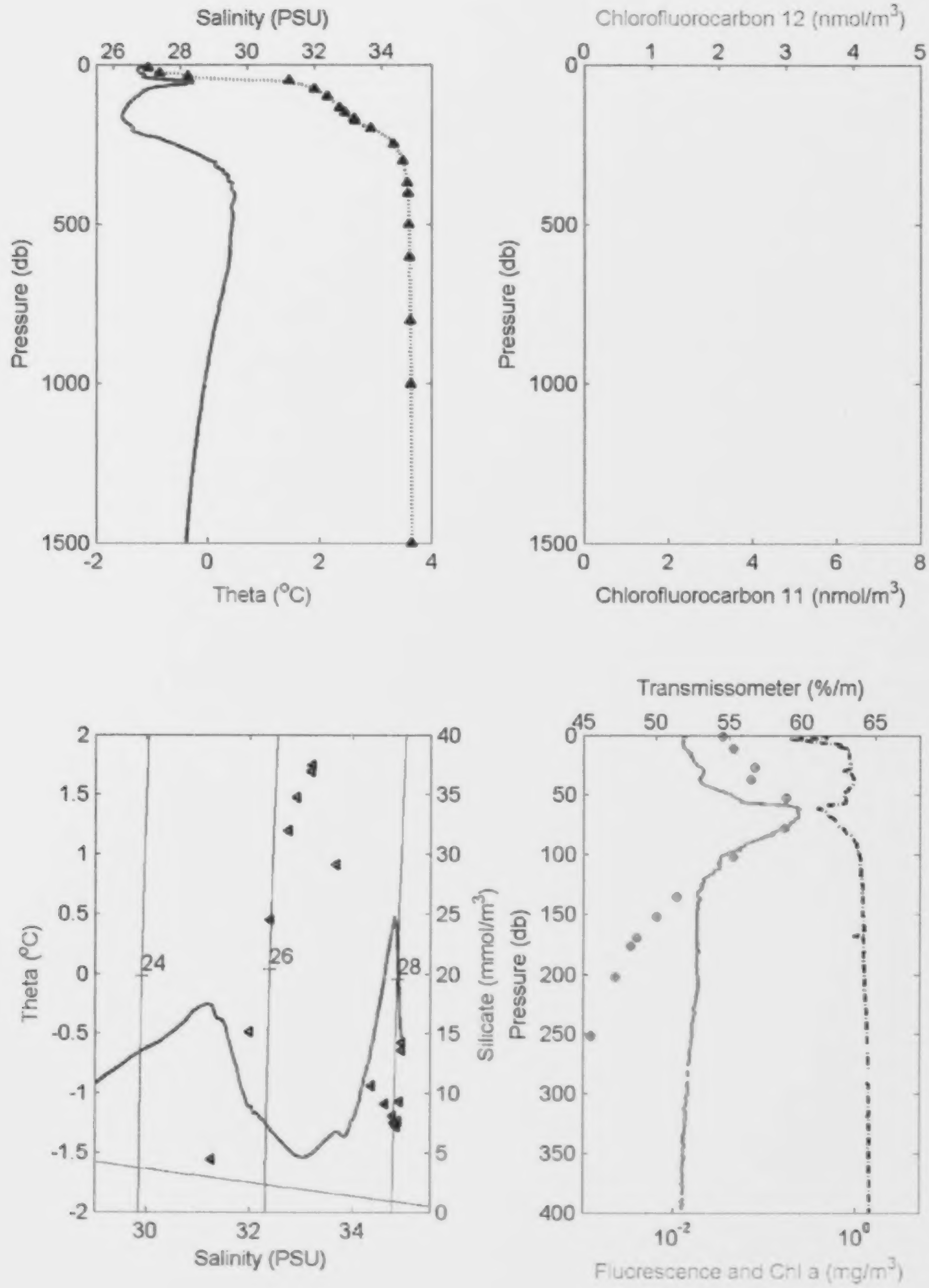
2003-21: Cast 44 Station LS36



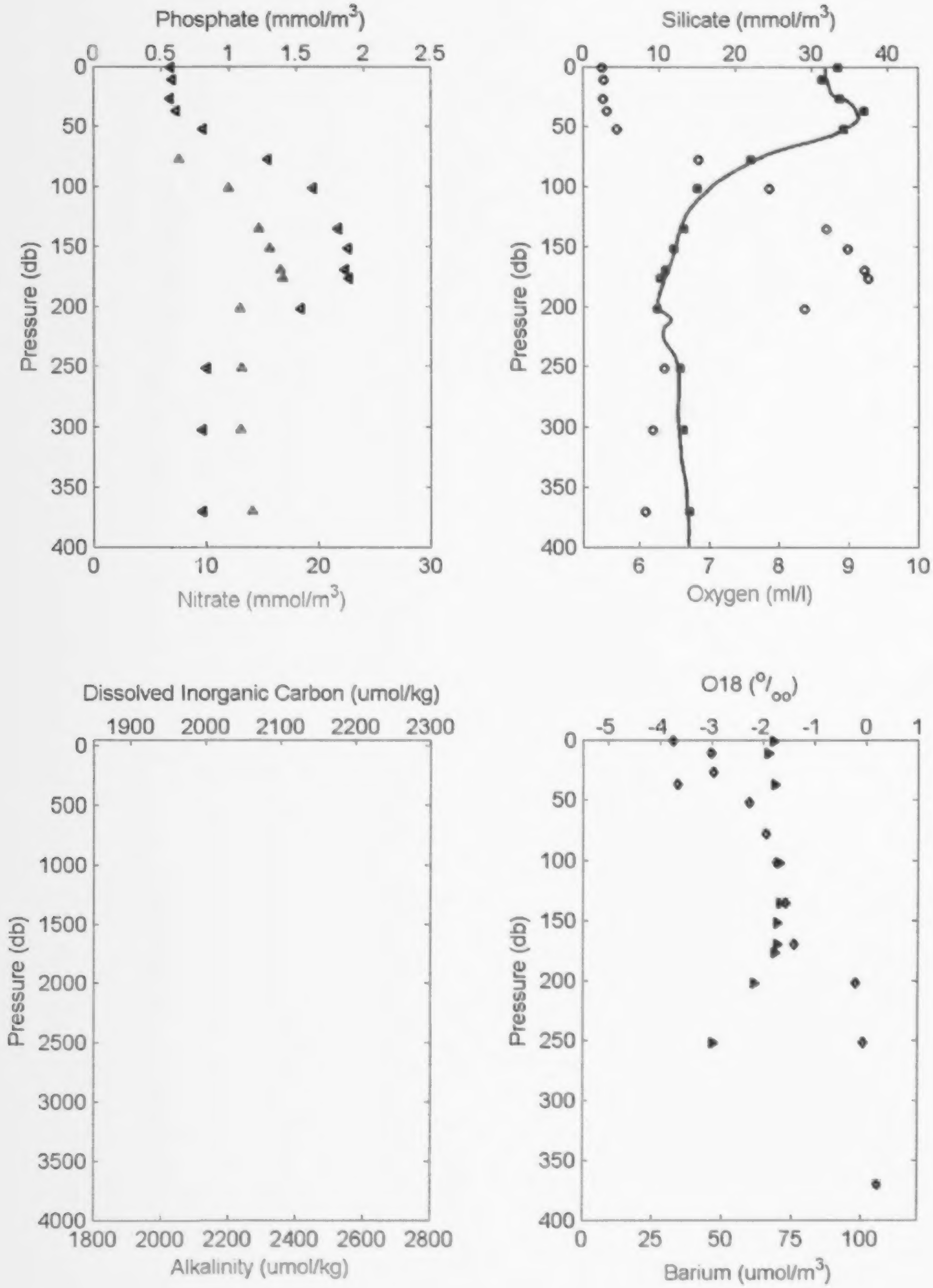
2003-21: Cast 44 Station LS36



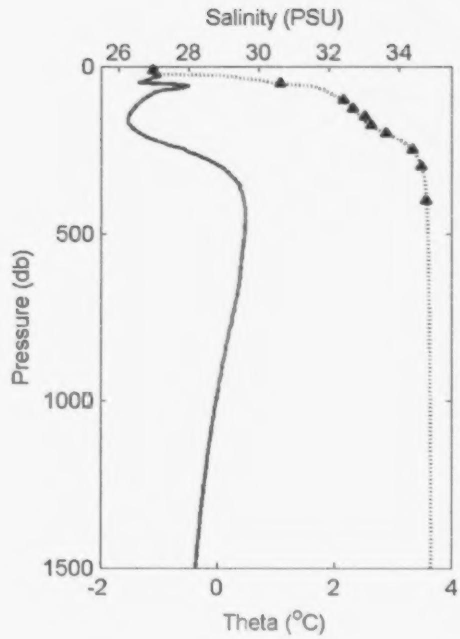
2003-21: Cast 45 Station LS37

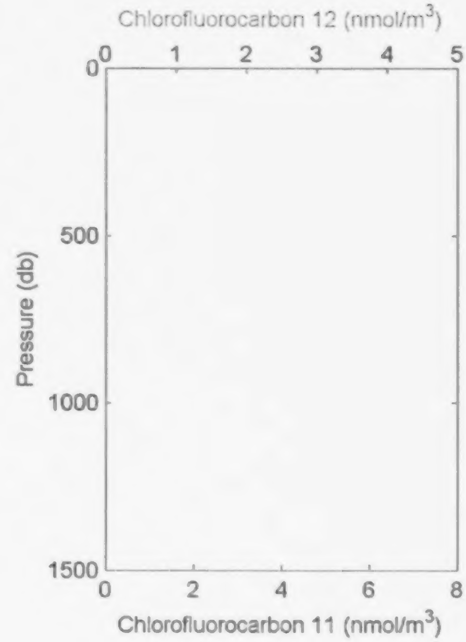


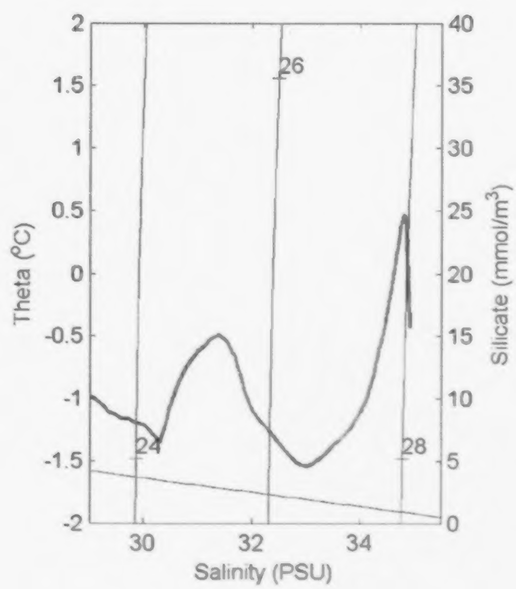
2003-21: Cast 45 Station LS37

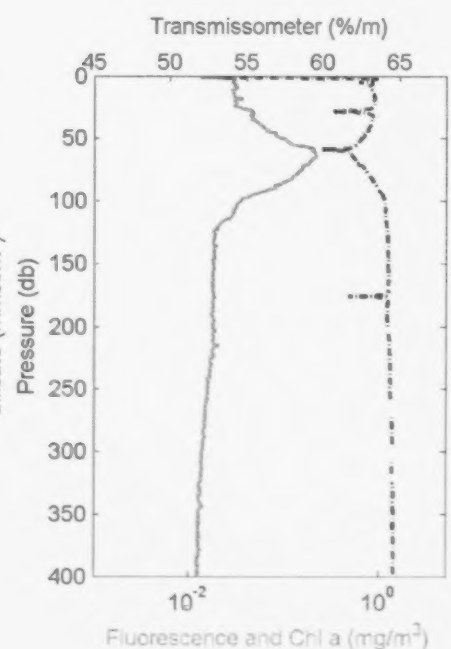


2003-21: Cast 46 Station LS38

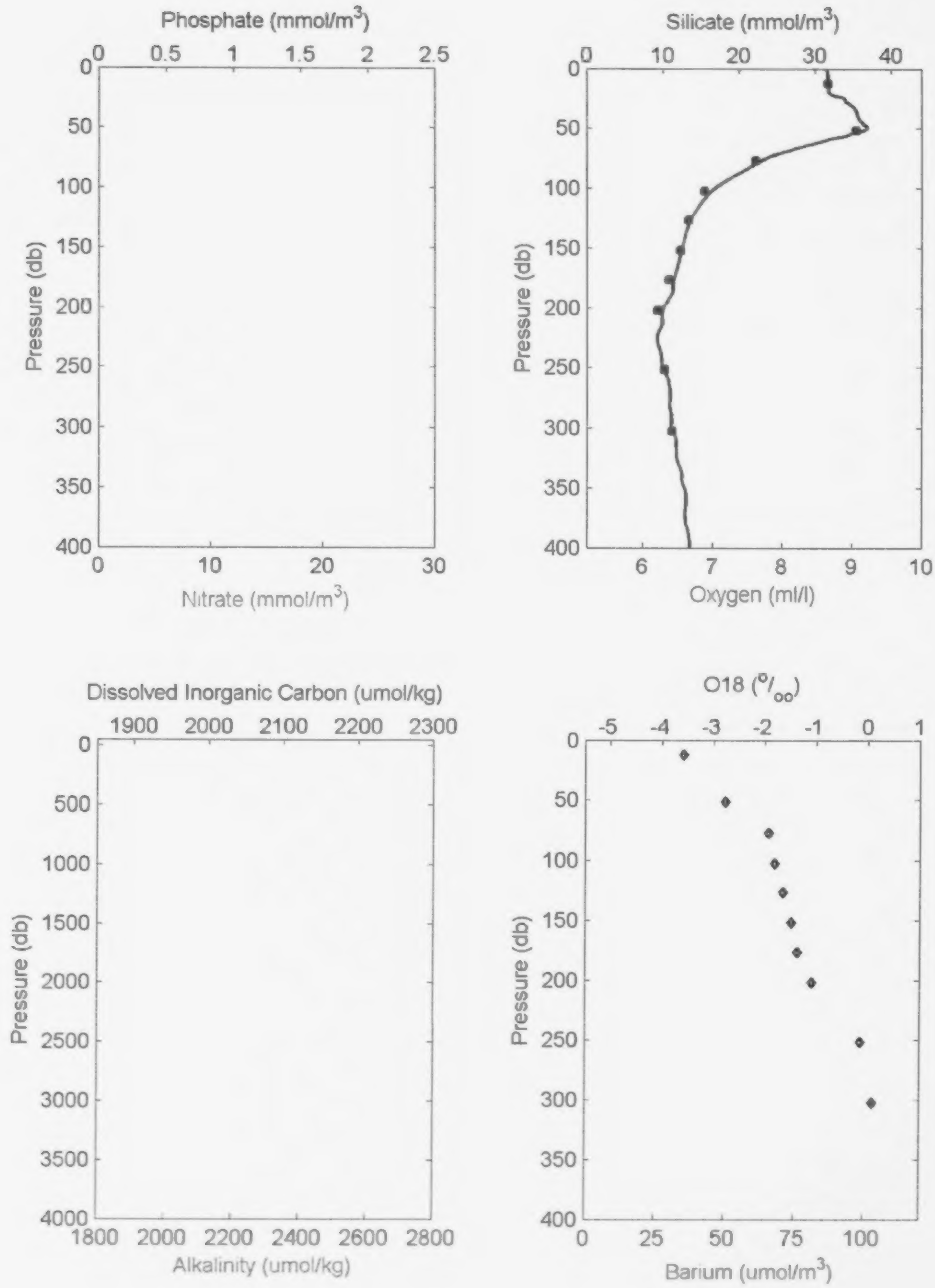




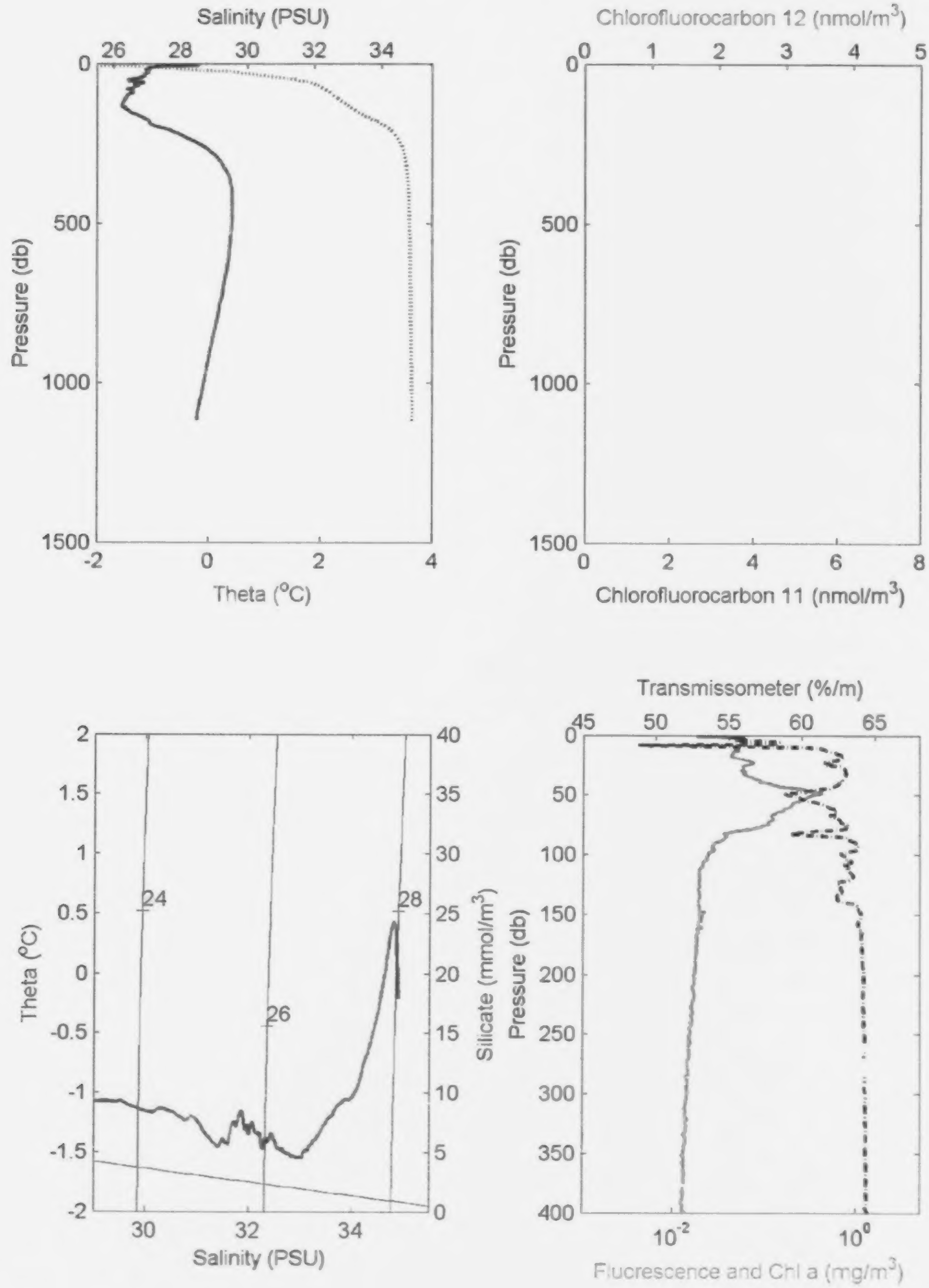




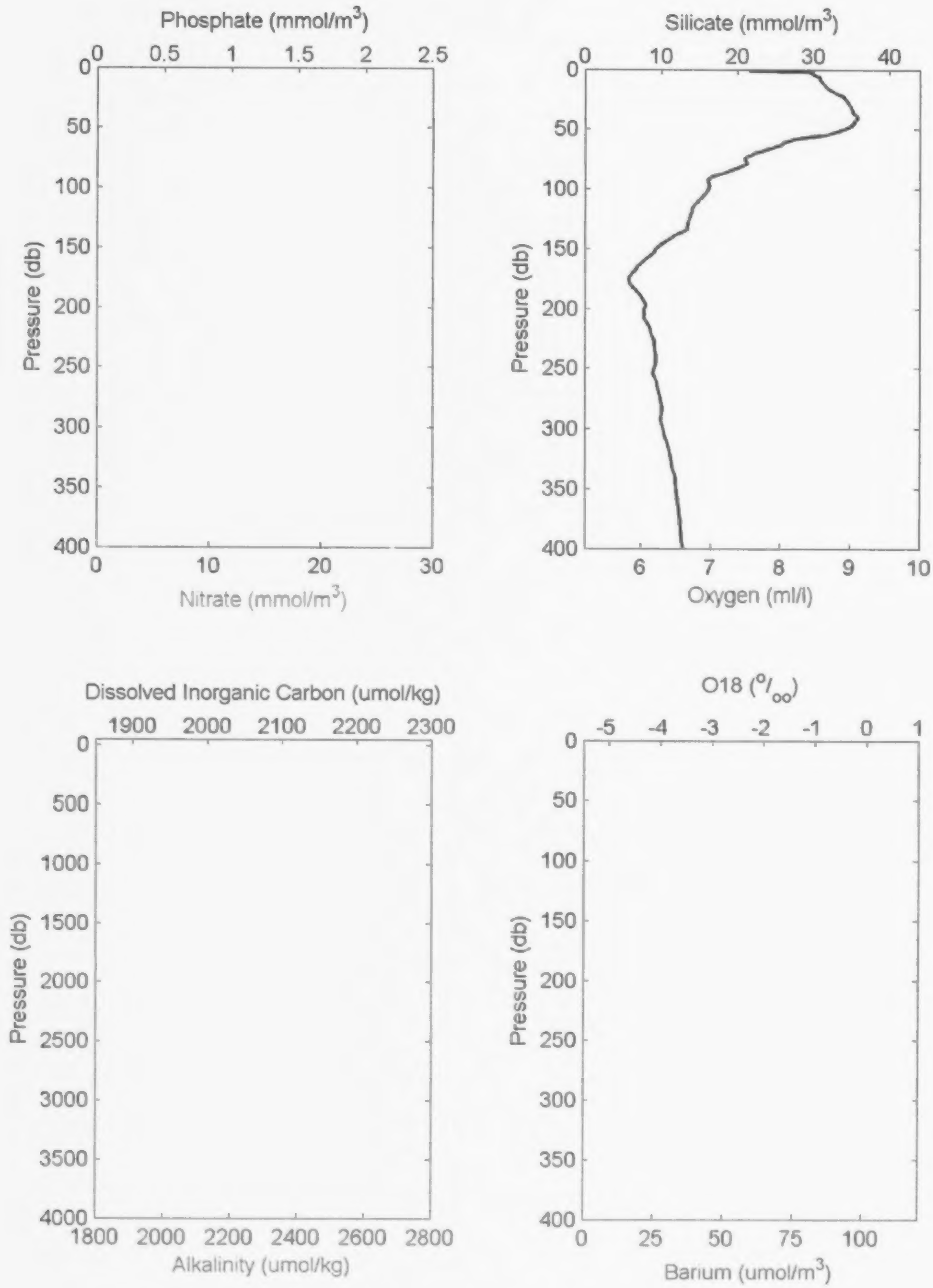
2003-21: Cast 46 Station LS38



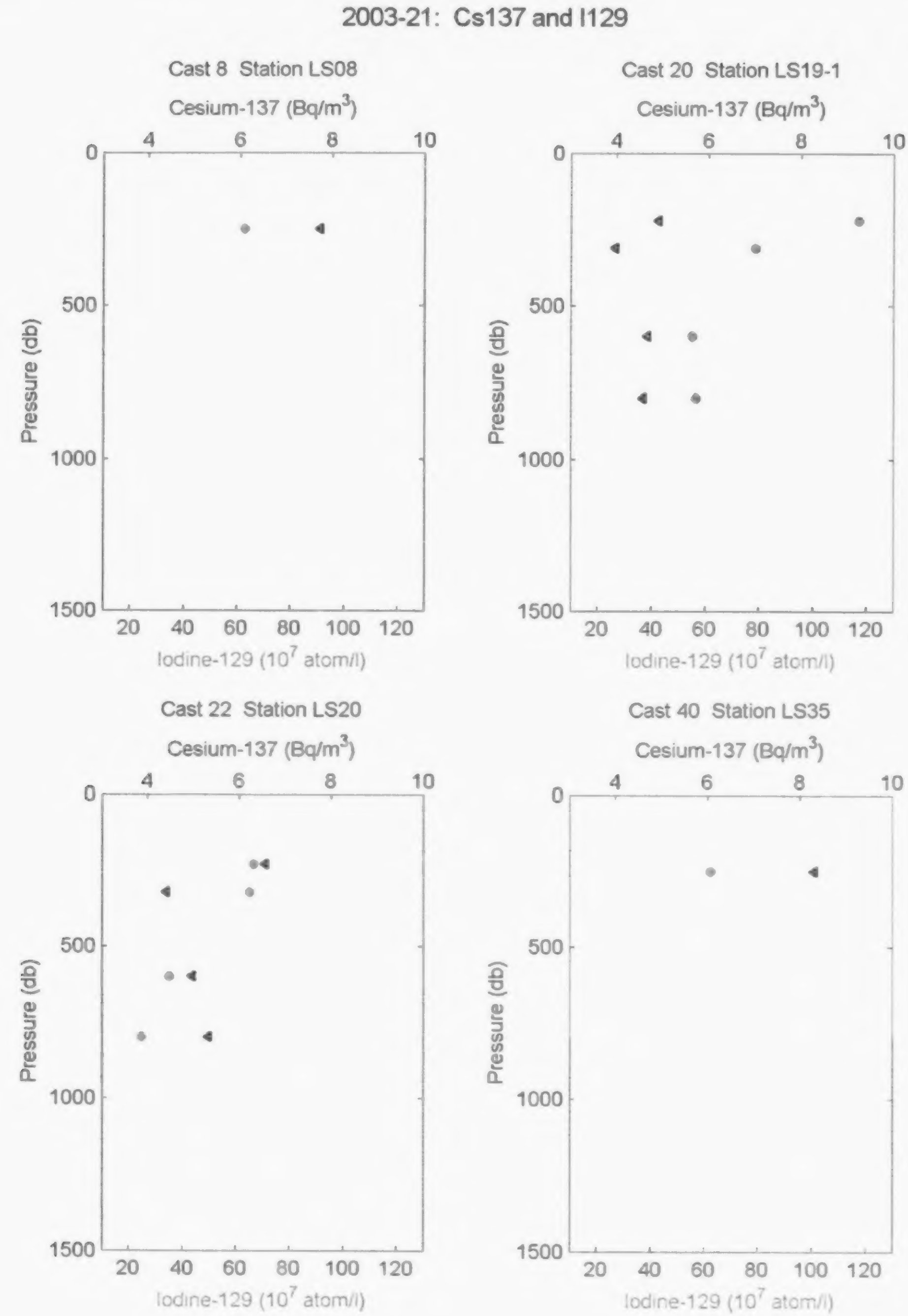
2003-21: Cast 47 Station LS39

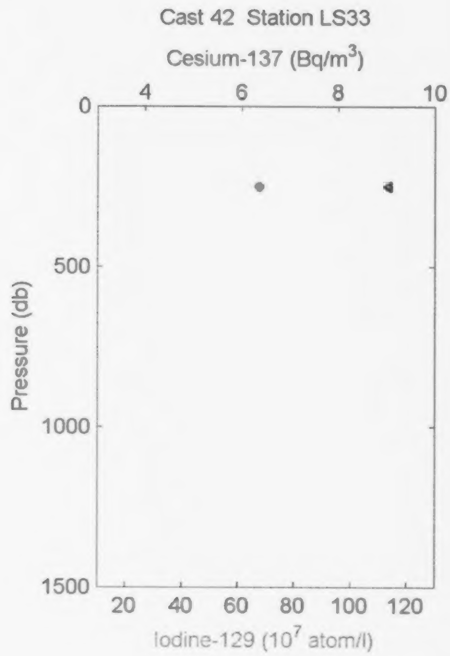


2003-21: Cast 47 Station LS39



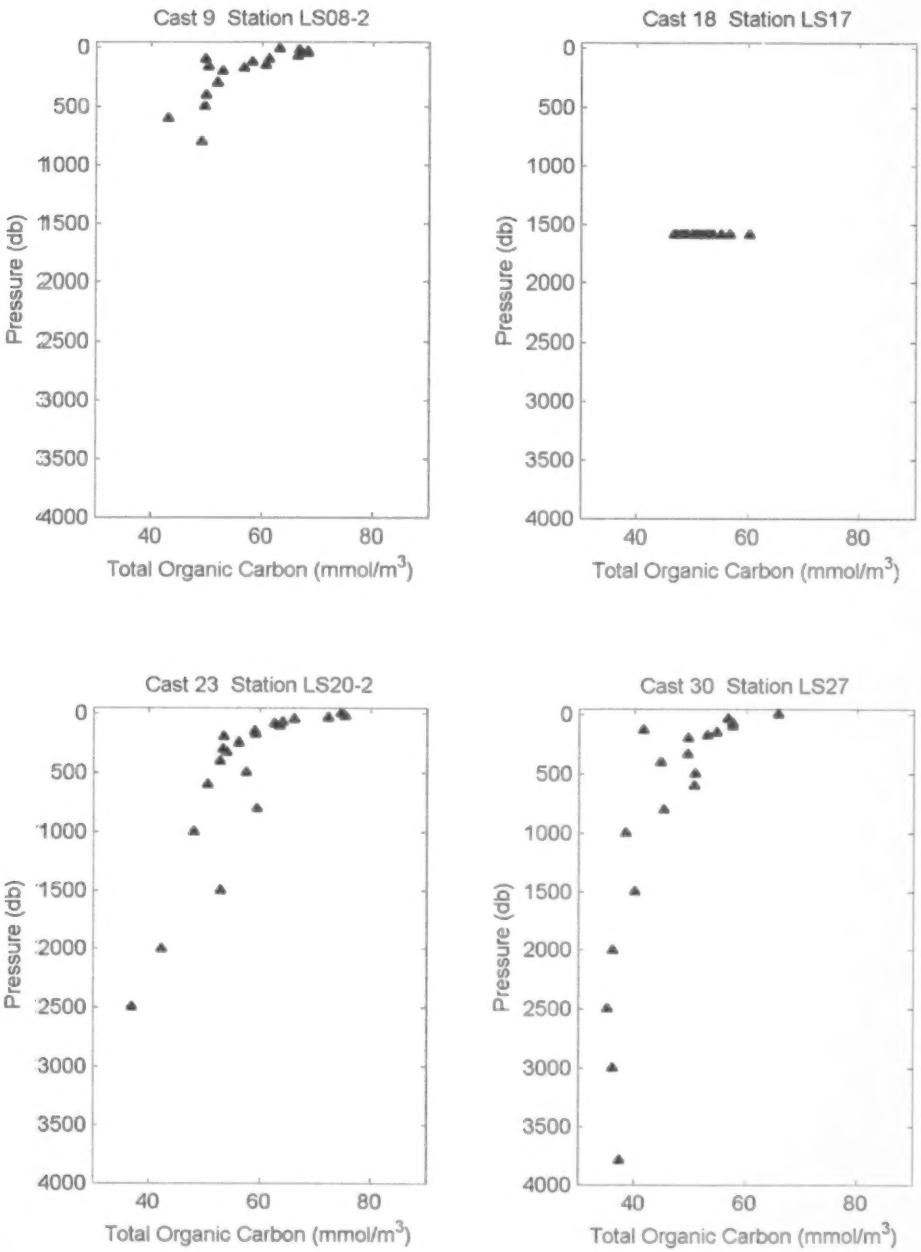
5.1 ^{129}I and ^{137}Cs

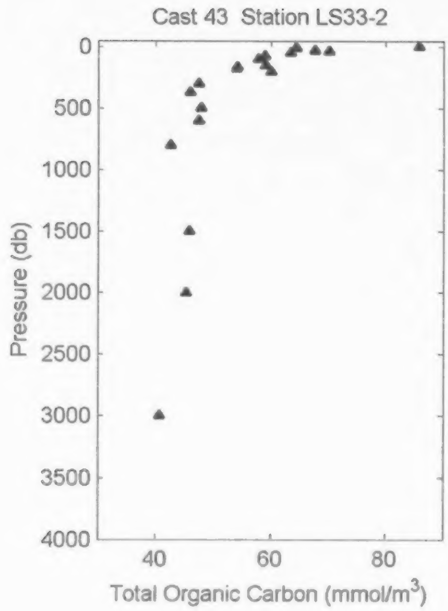



Cast 42 Station LS33
Cesium-137 (Bq/m3)
4
6
8
10
0
500
1000
1500
Pressure (db)
20
40
60
80
100
120
Iodine-129 (10^7 atom/l)

5.2 TOC

2003-21: TOC

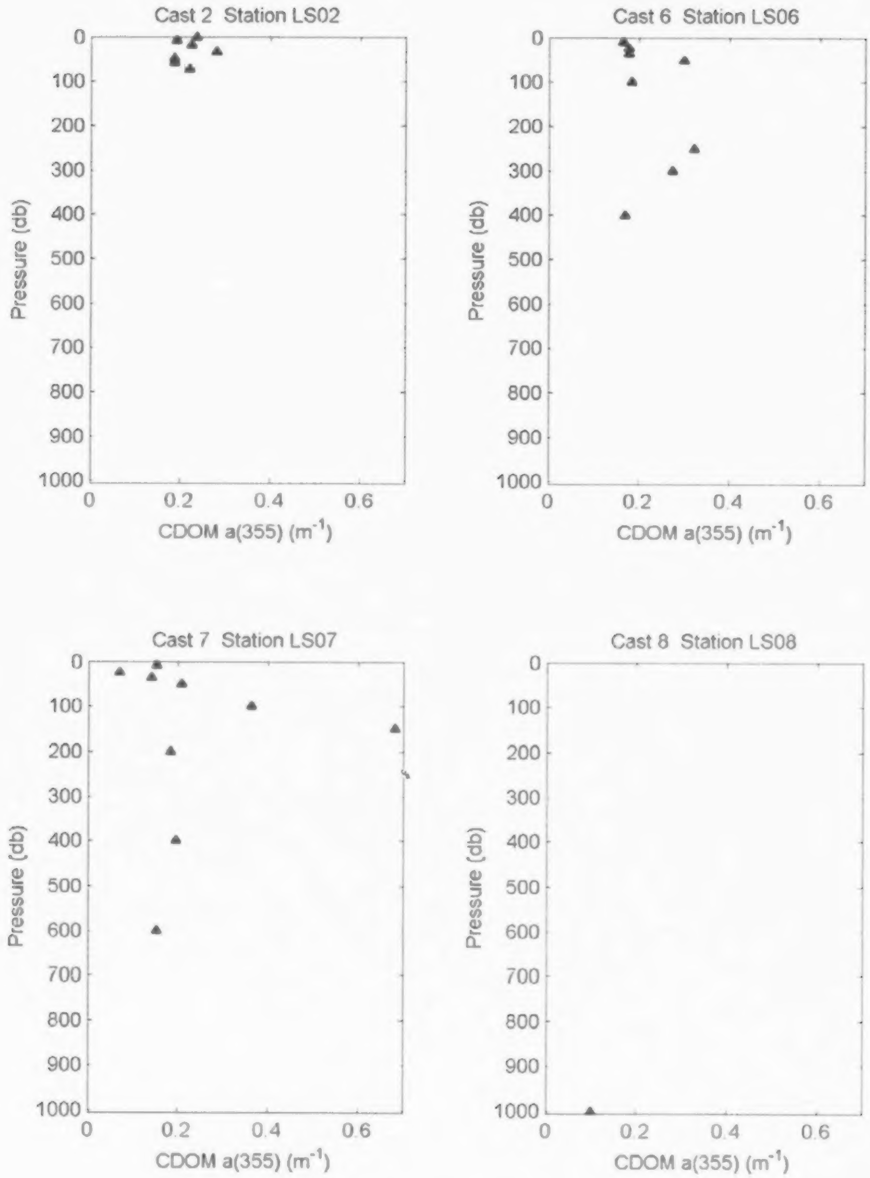




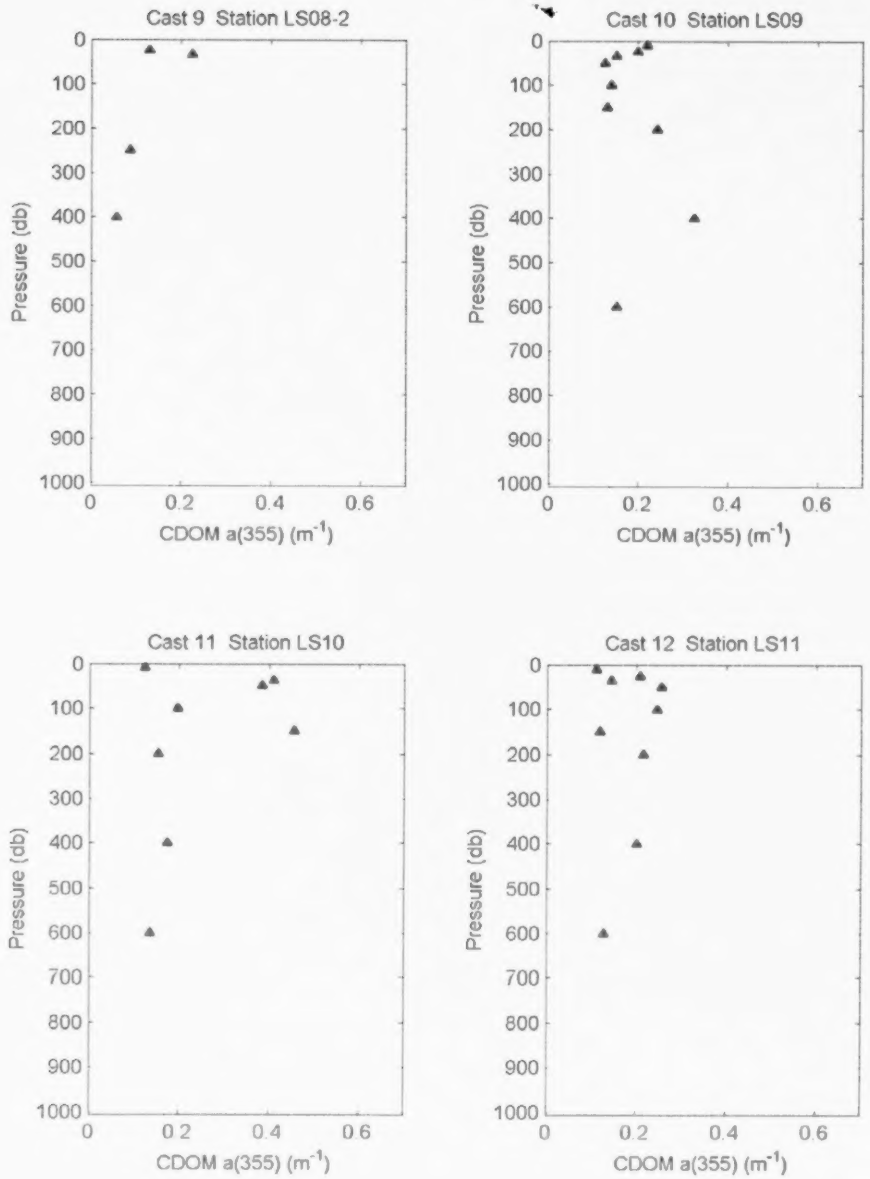
Cast 43 Station LS33-2
Pressure (db)
0
500
1000
1500
2000
2500
3000
3500
4000
40
60
80
Total Organic Carbon (mmol/m3)

5.3 CDOM

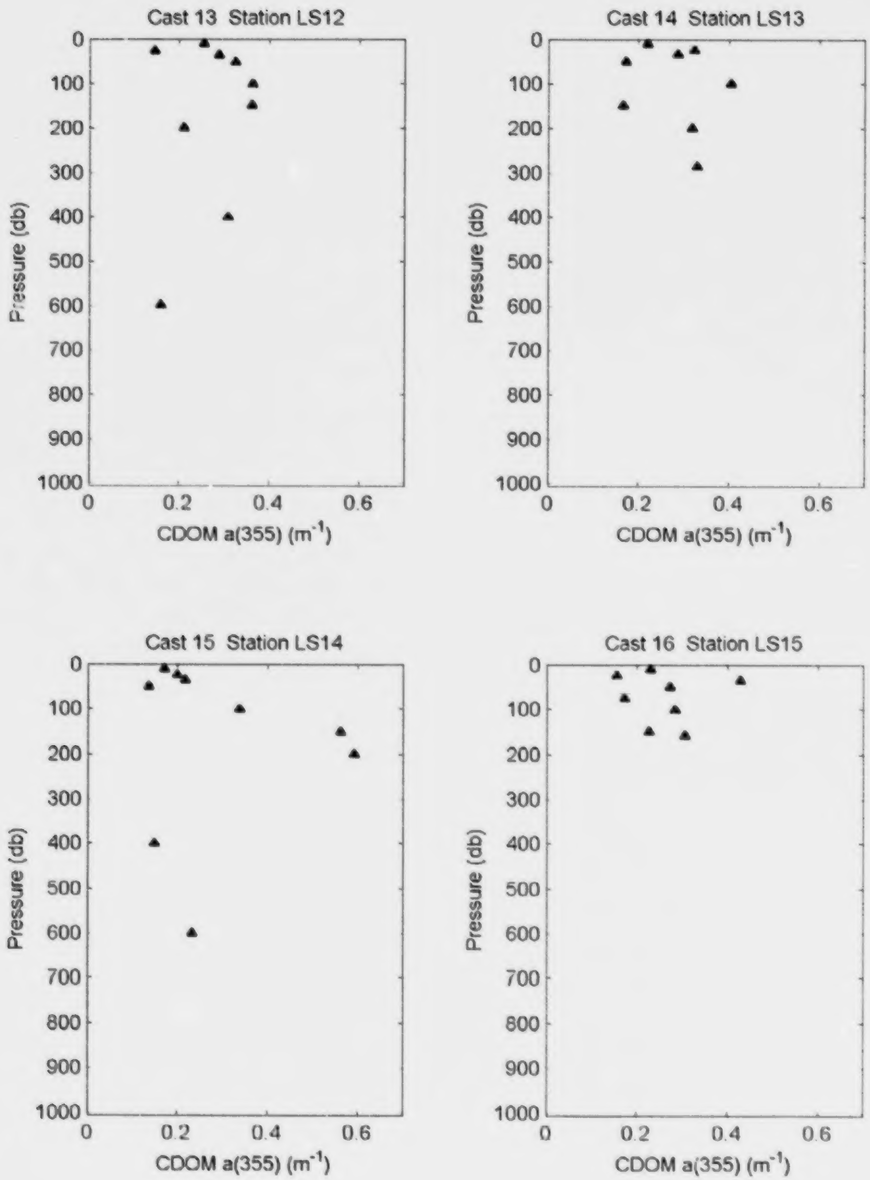
2003-21: CDOM a(355)



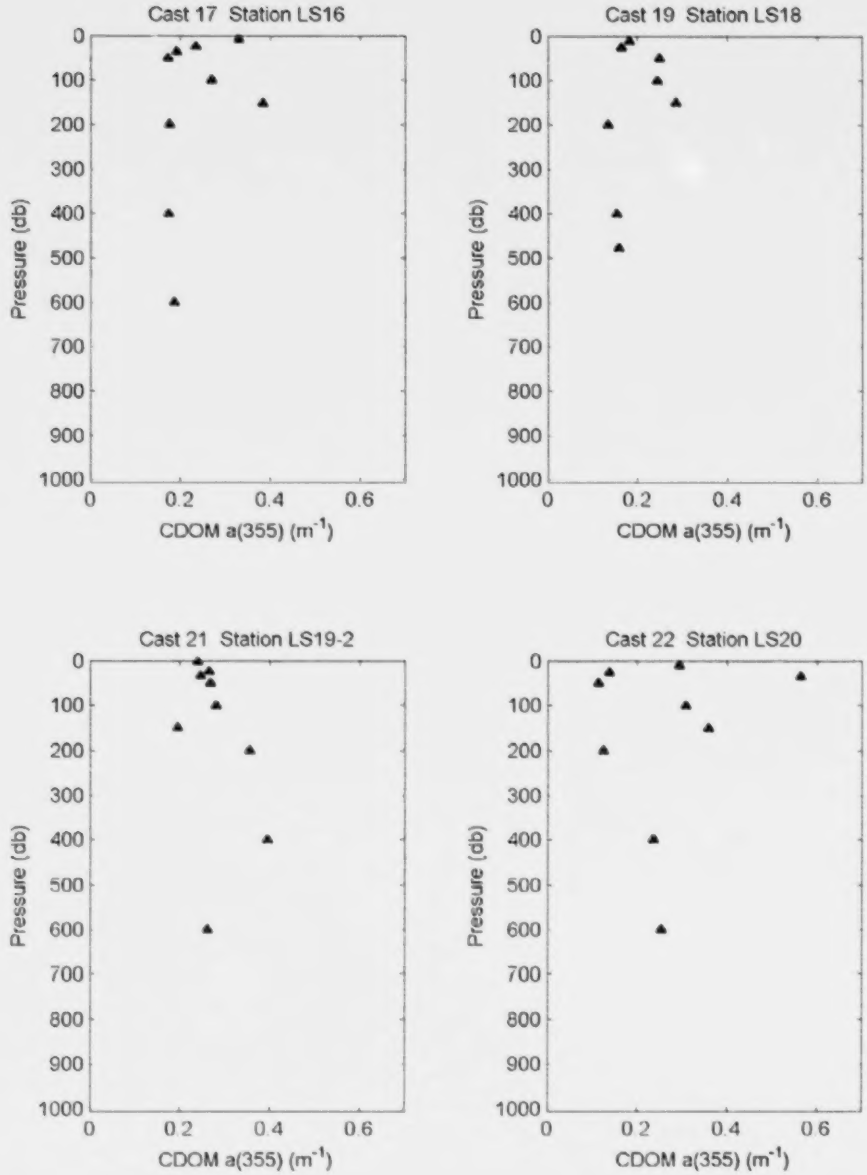
2003-21: CDOM a(355)



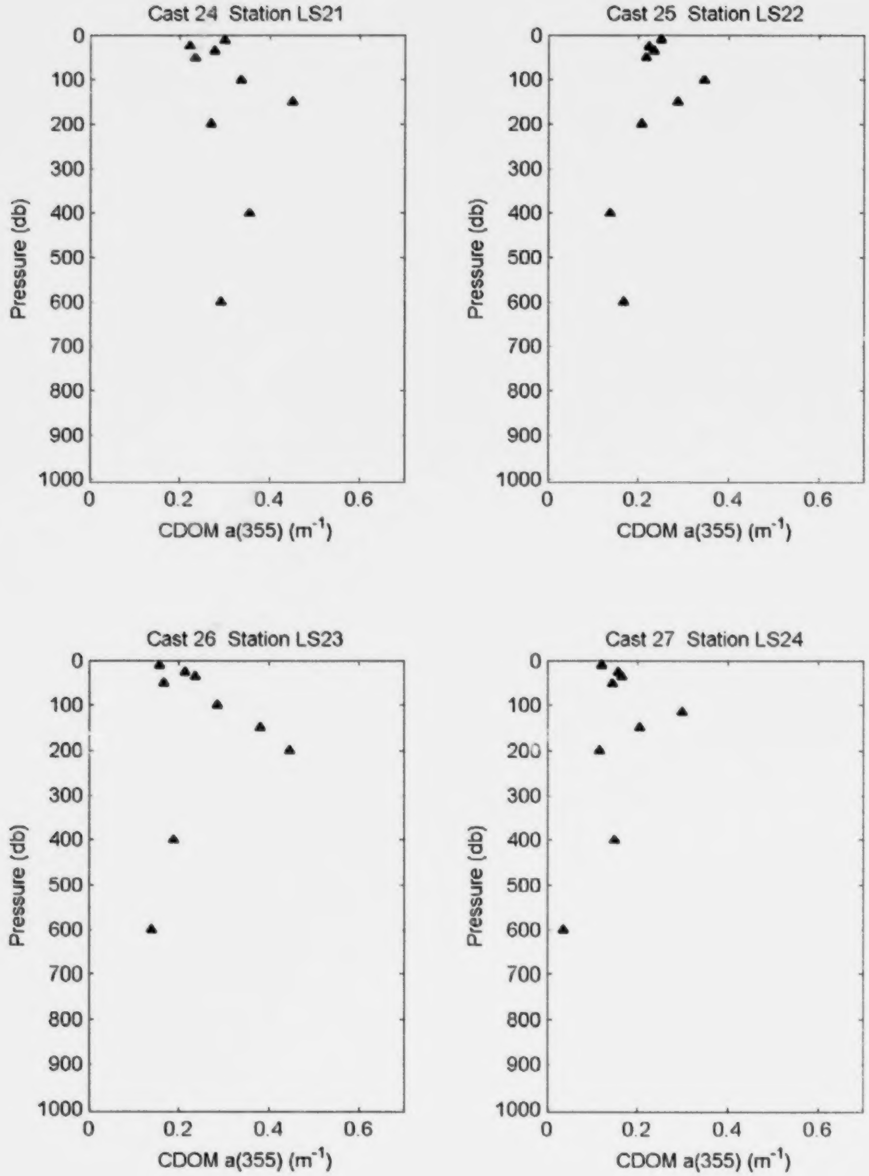
2003-21: CDOM a(355)



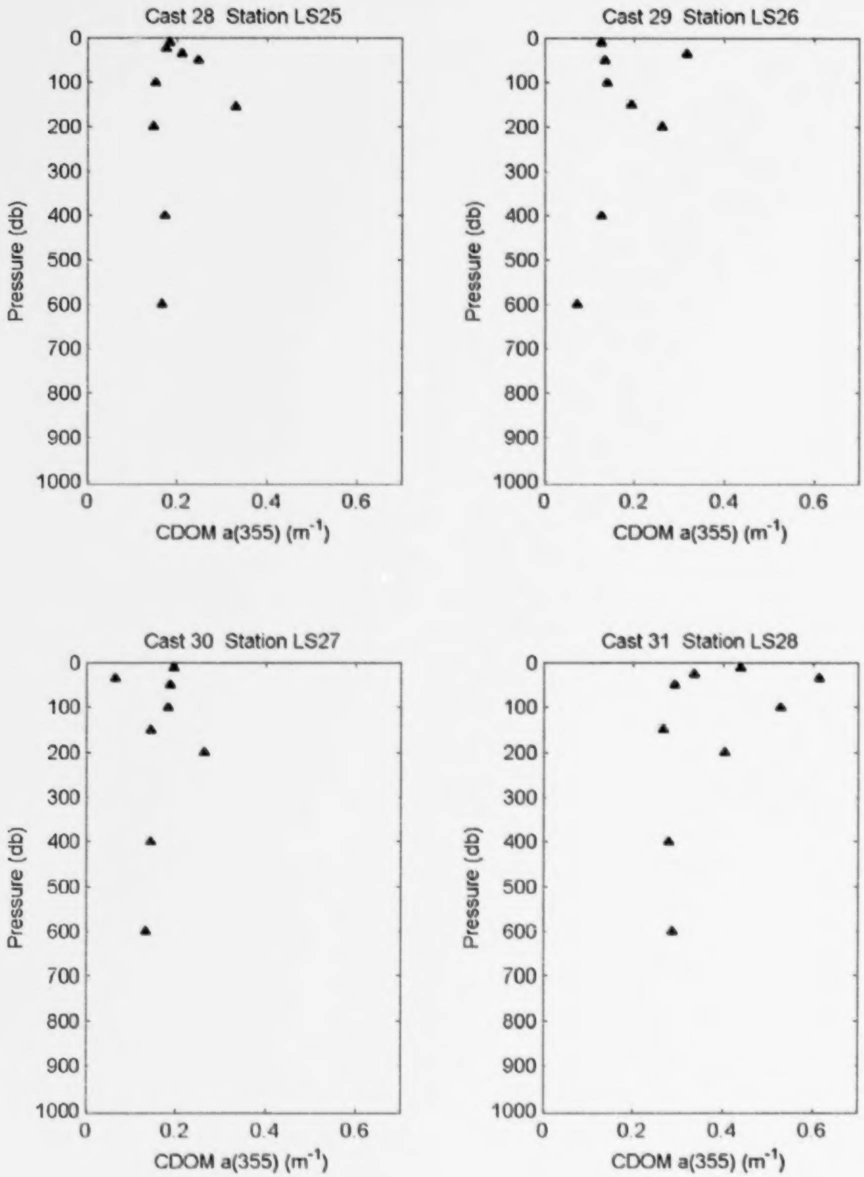
2003-21: CDOM a(355)



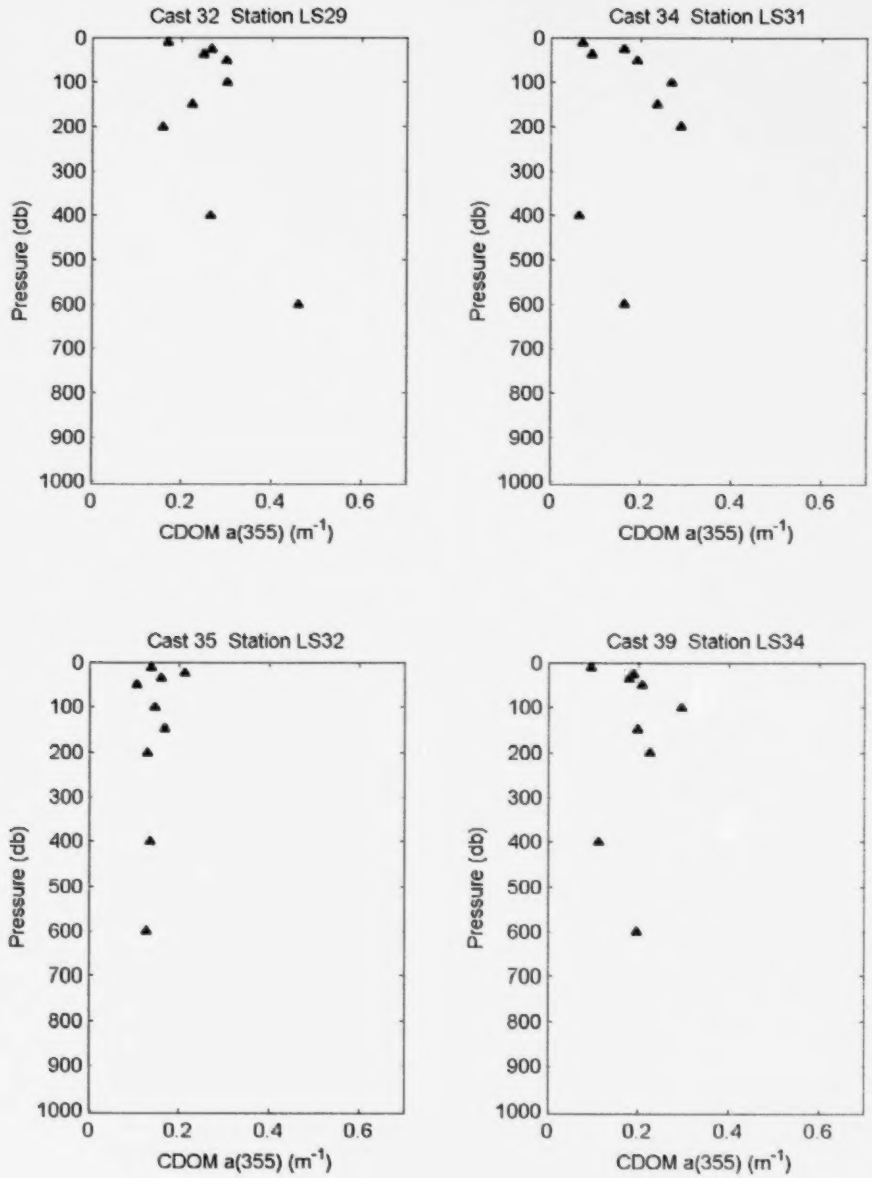
2003-21: CDOM a(355)



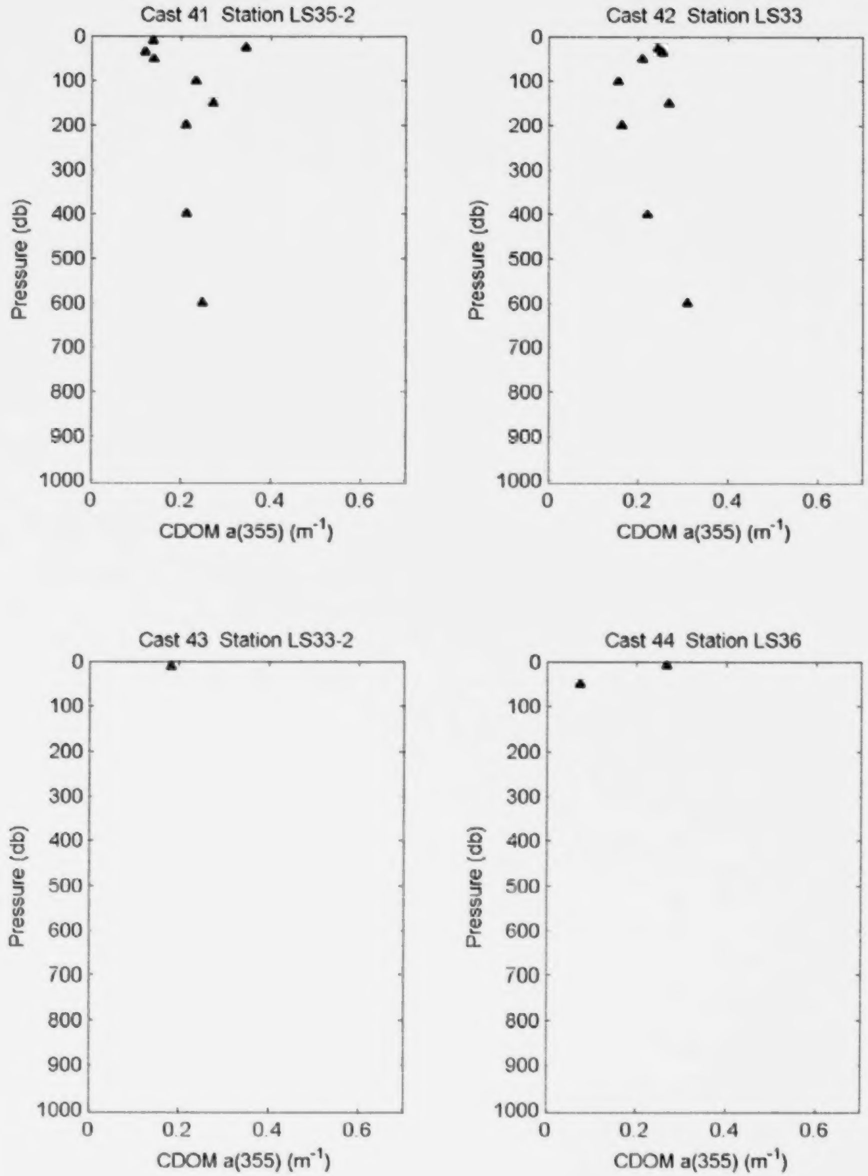
2003-21: CDOM a(355)



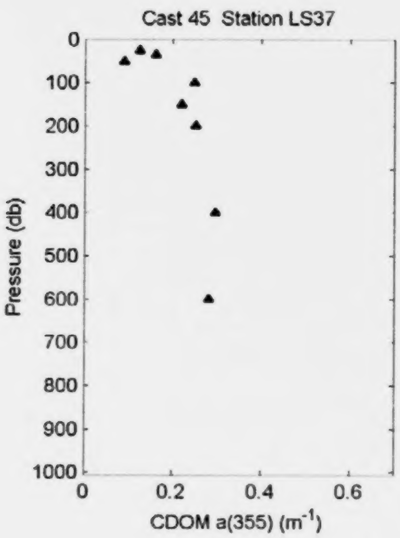
2003-21: CDOM a(355)



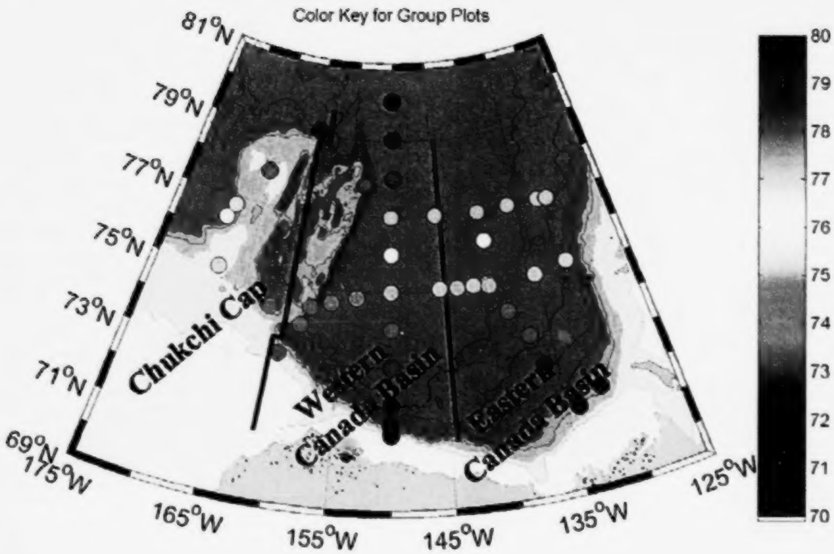
2003-21: CDOM a(355)



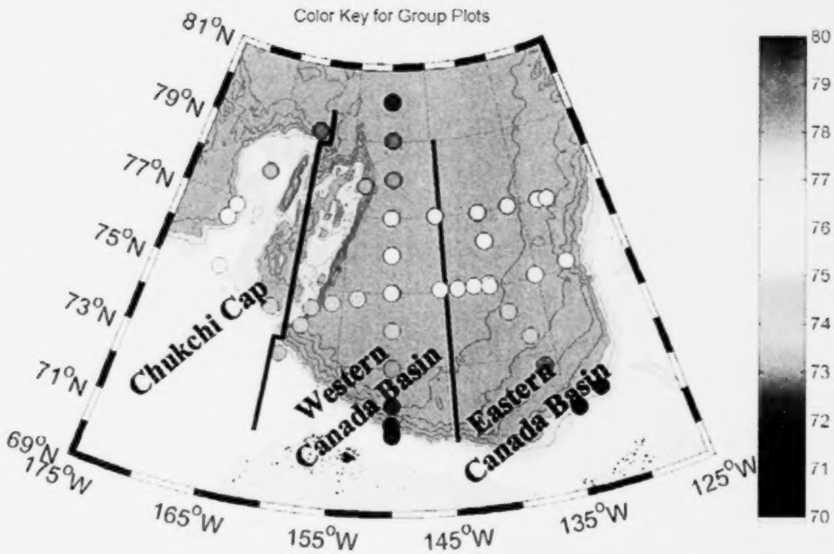
2003-21: CDOM a(355)



6. PROPERTY PLOTS

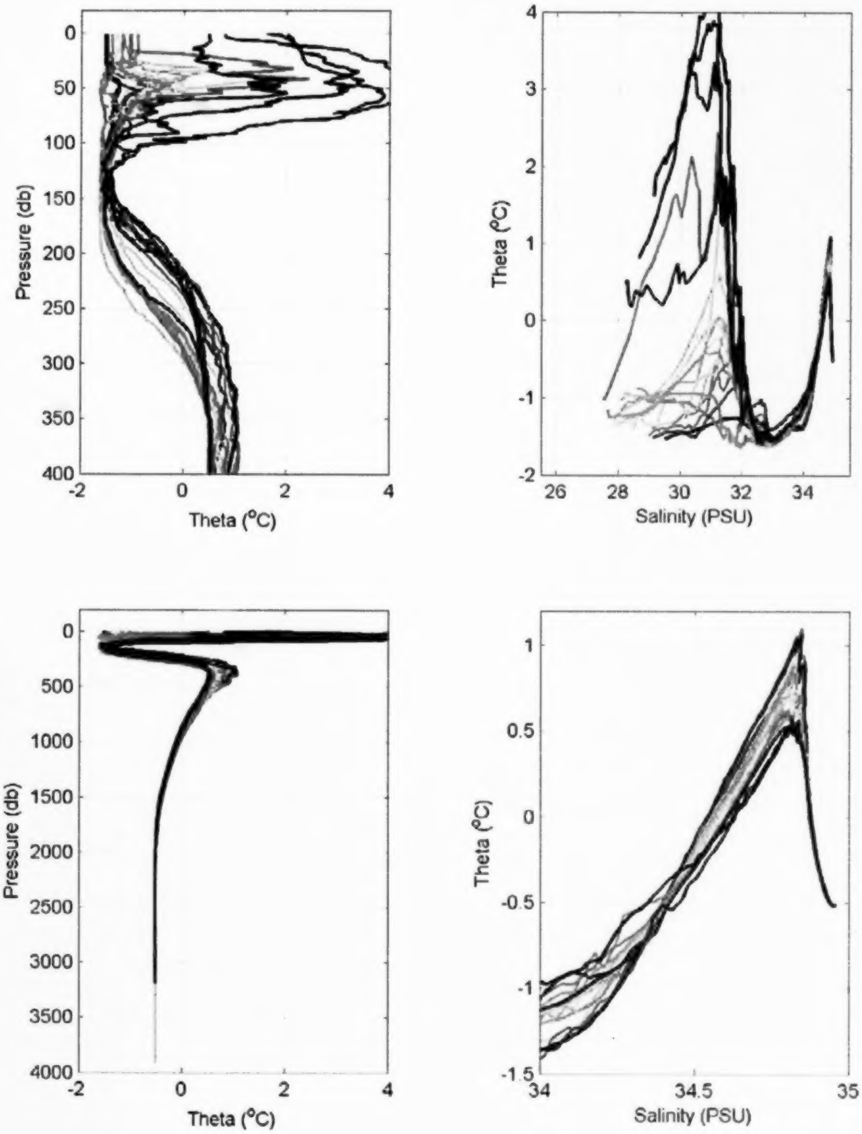


6. PROPERTY PLOTS

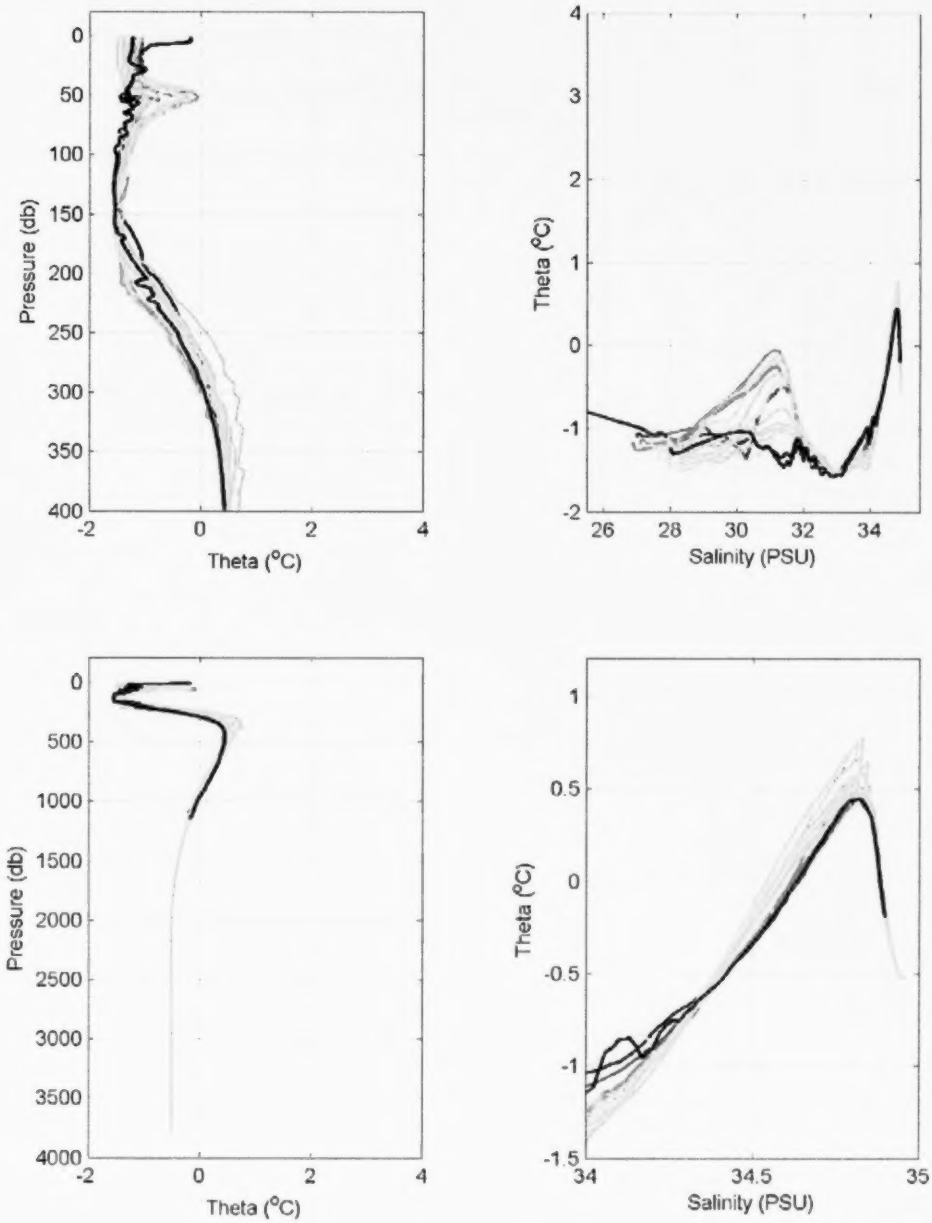


6.1 Western and Eastern Canada Basin

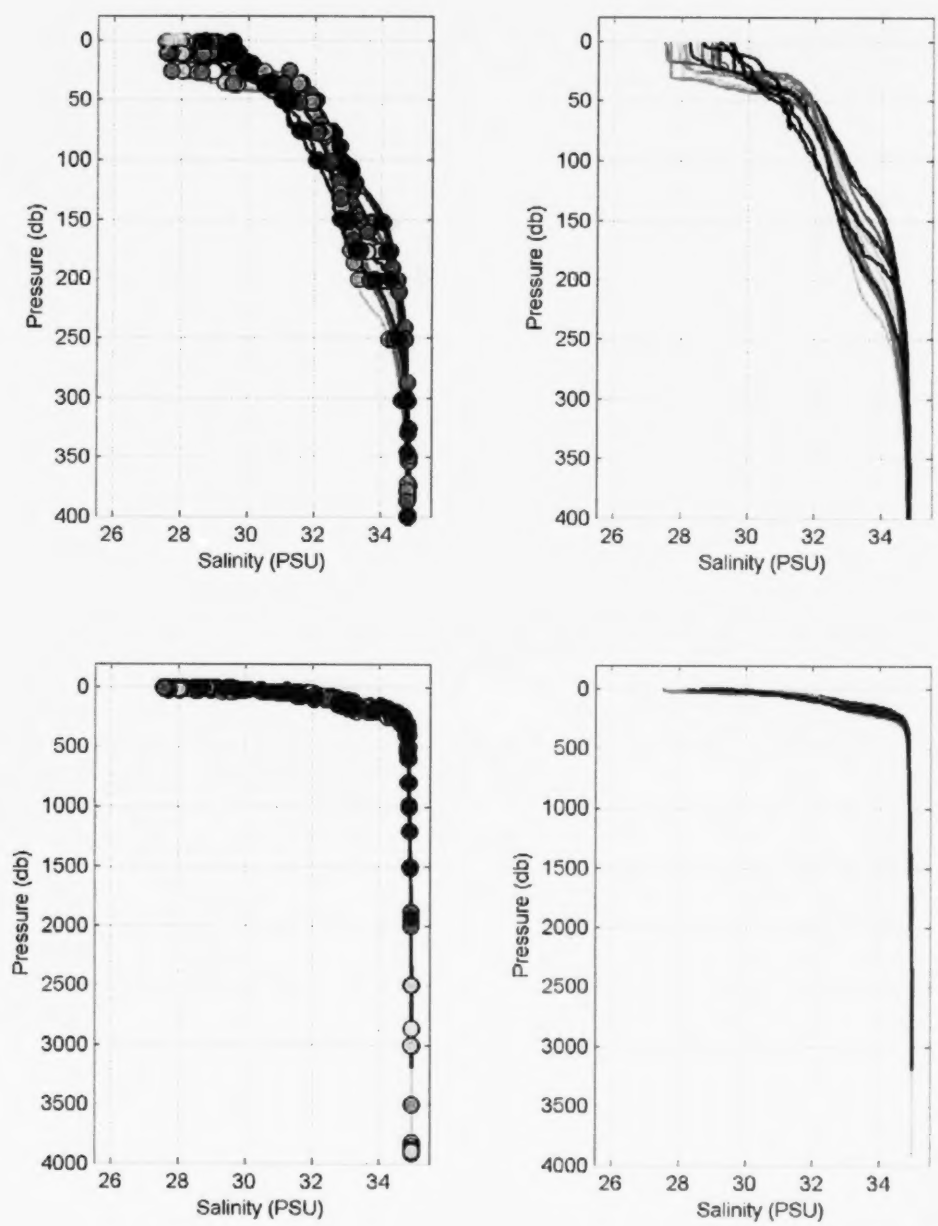
2003-21 Western Canda Basin (145 to 160°W), Property: Theta



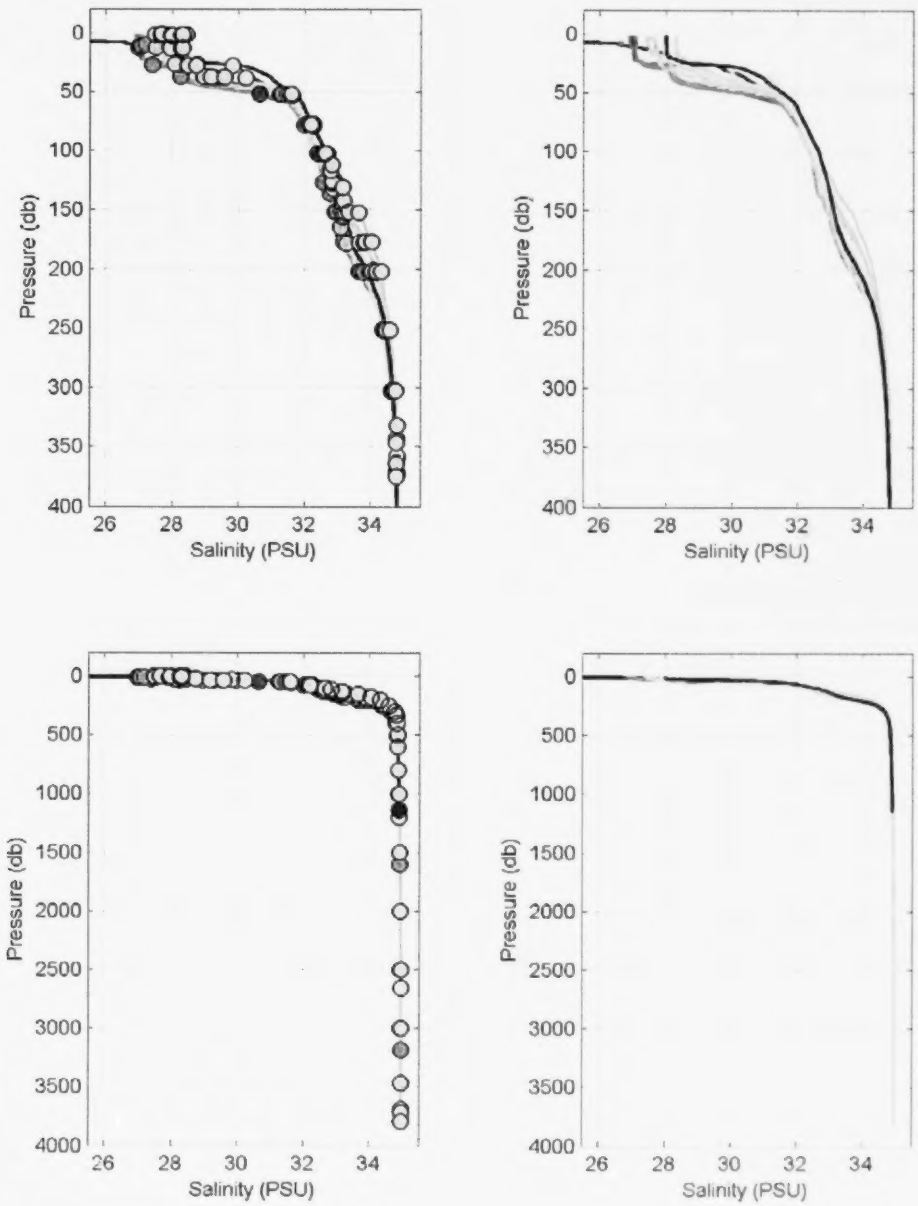
2003-21 Eastern Canada Basin (East of 145°W), Property: Theta



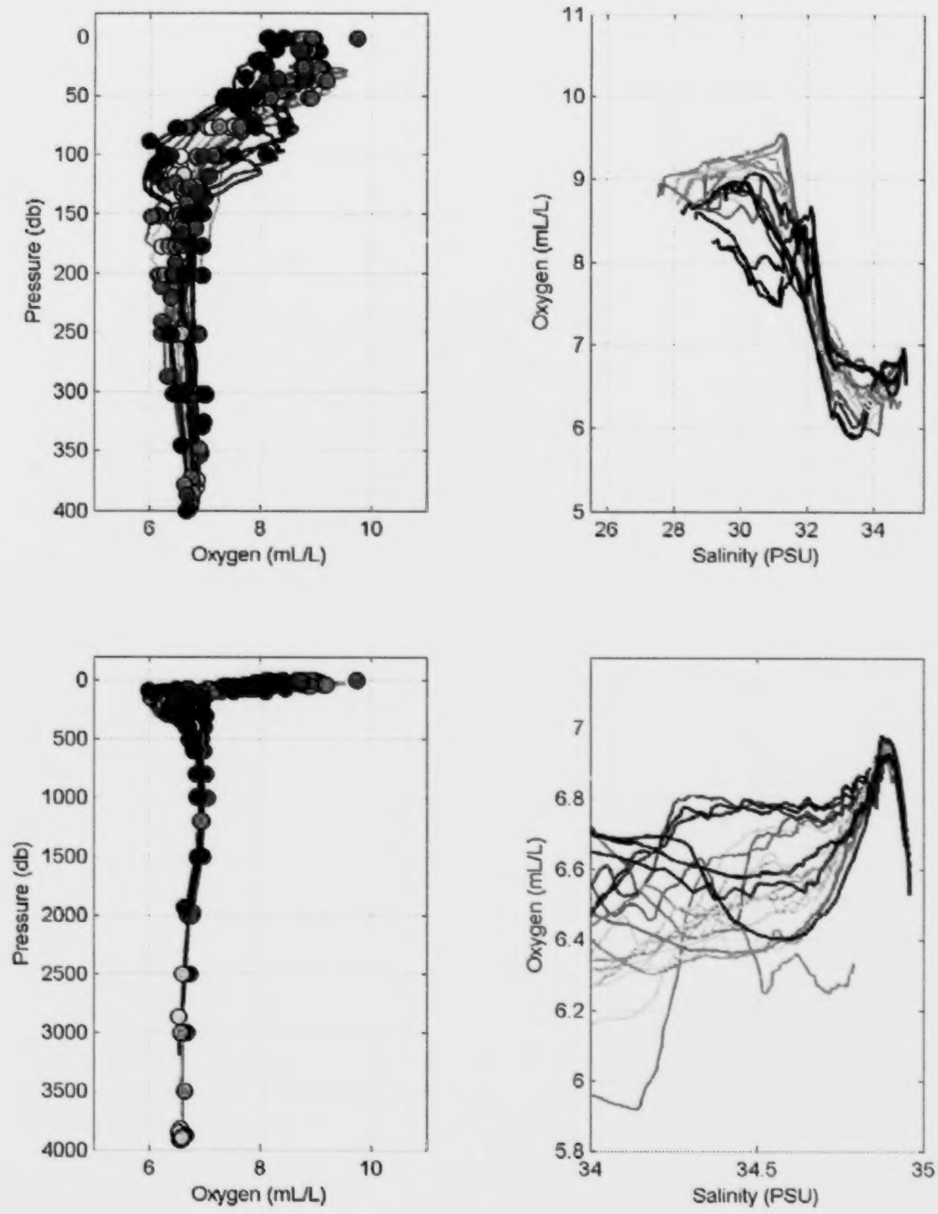
2003-21 Western Canda Basin (145 to 160°W), Property: Salinity



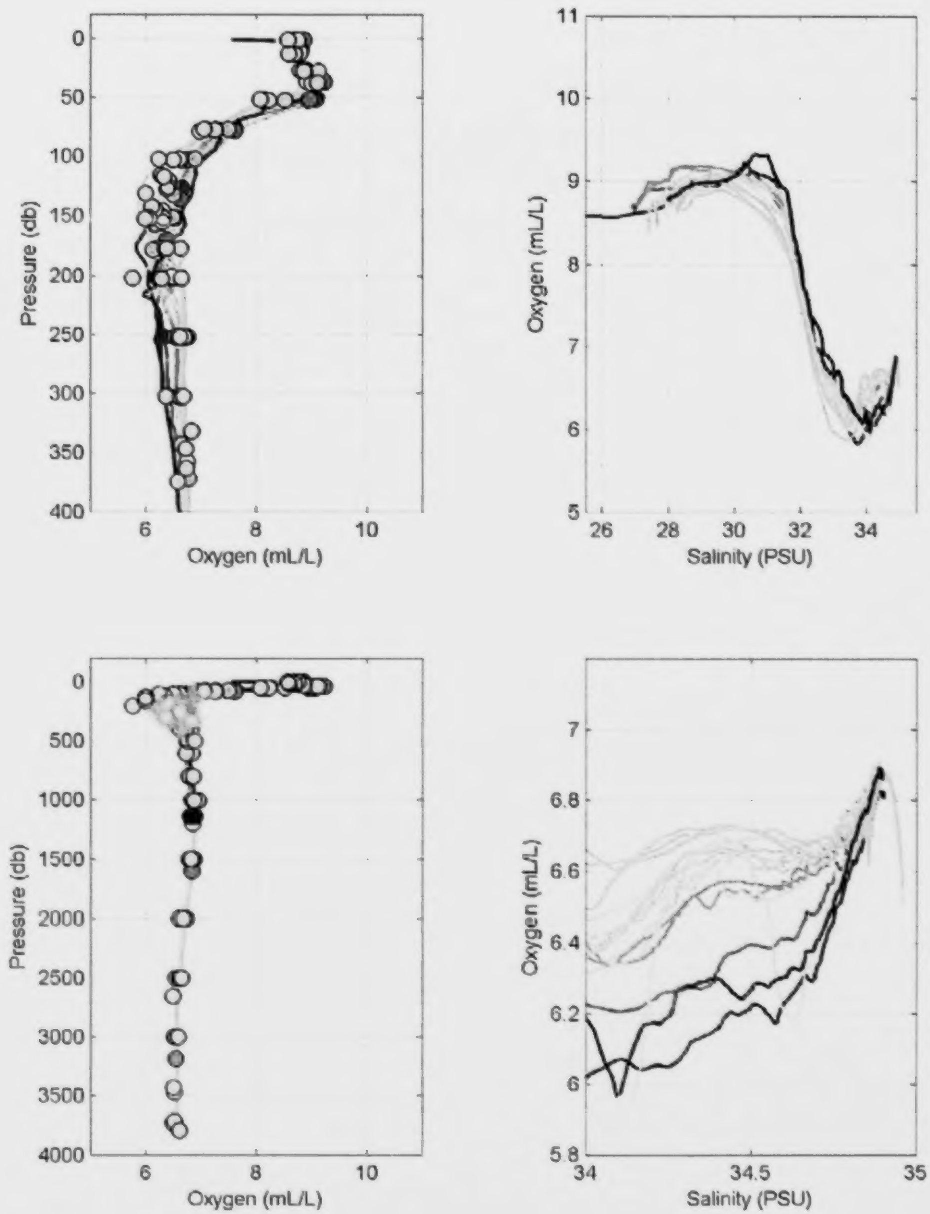
2003-21 Eastern Canada Basin (East of 145°W), Property: Salinity



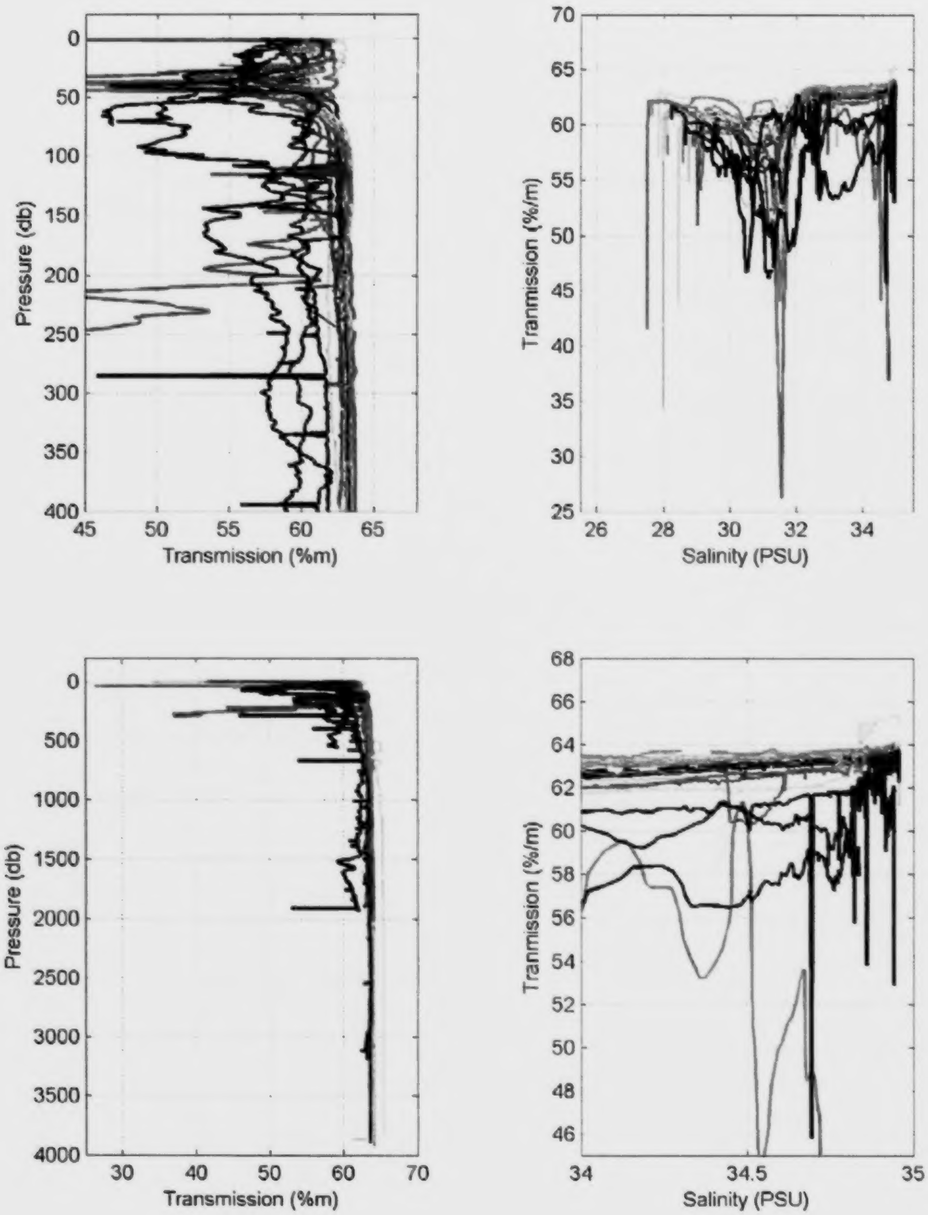
2003-21 Western Canda Basin (145 to 160°W), Property: Oxygen



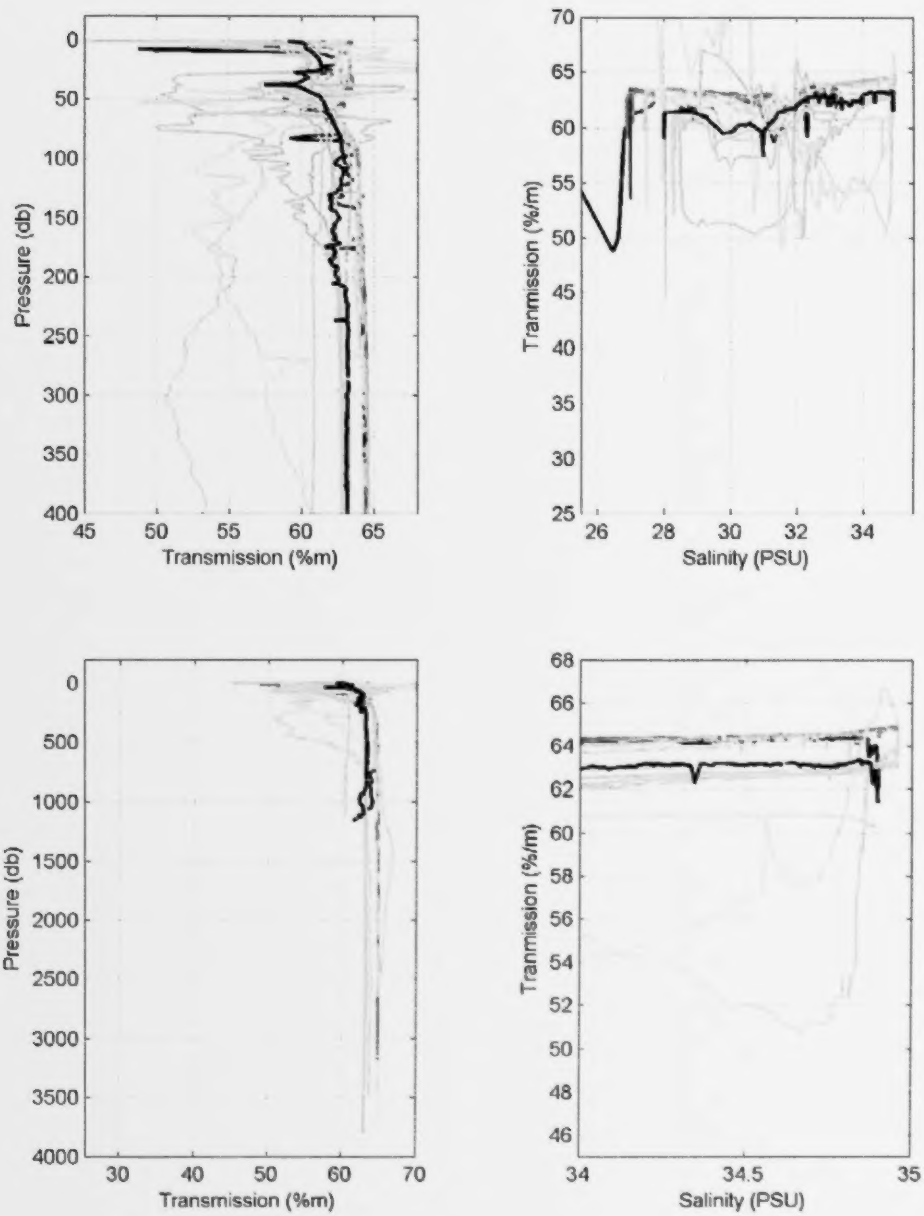
2003-21 Eastern Canada Basin (East of 145°W), Property: Oxygen



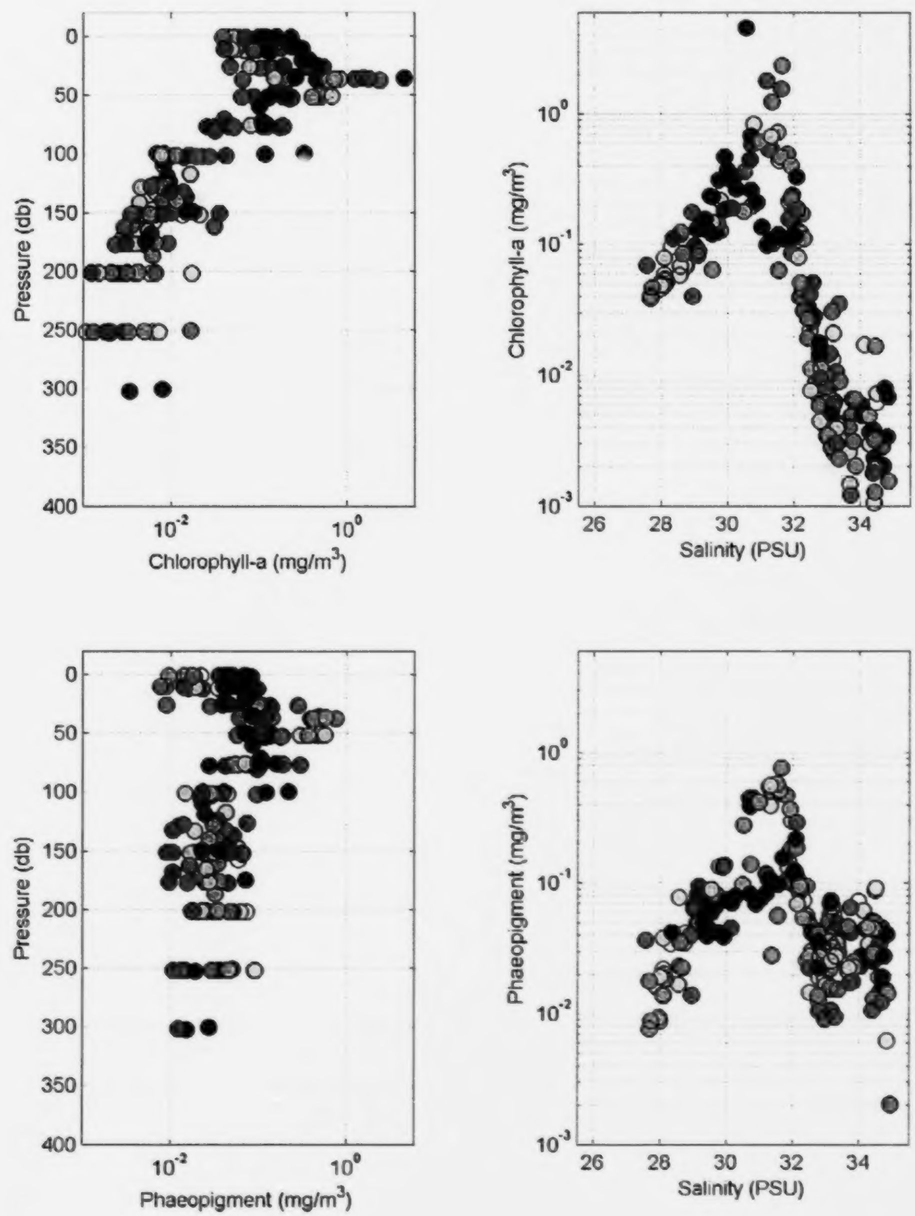
2003-21 Western Canda Basin (145 to 160°W), Property: Transmission



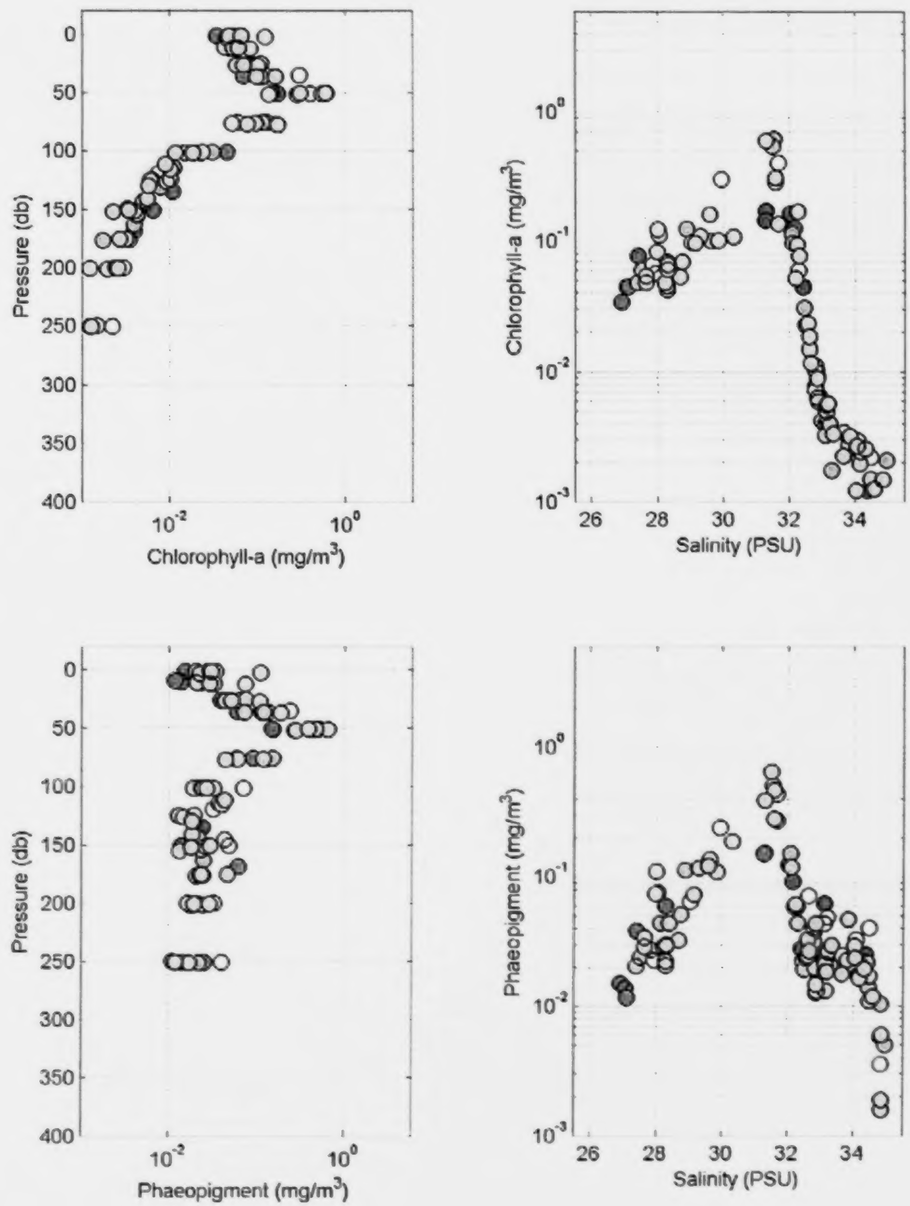
2003-21 Eastern Canada Basin (East of 145°W), Property: Transmission



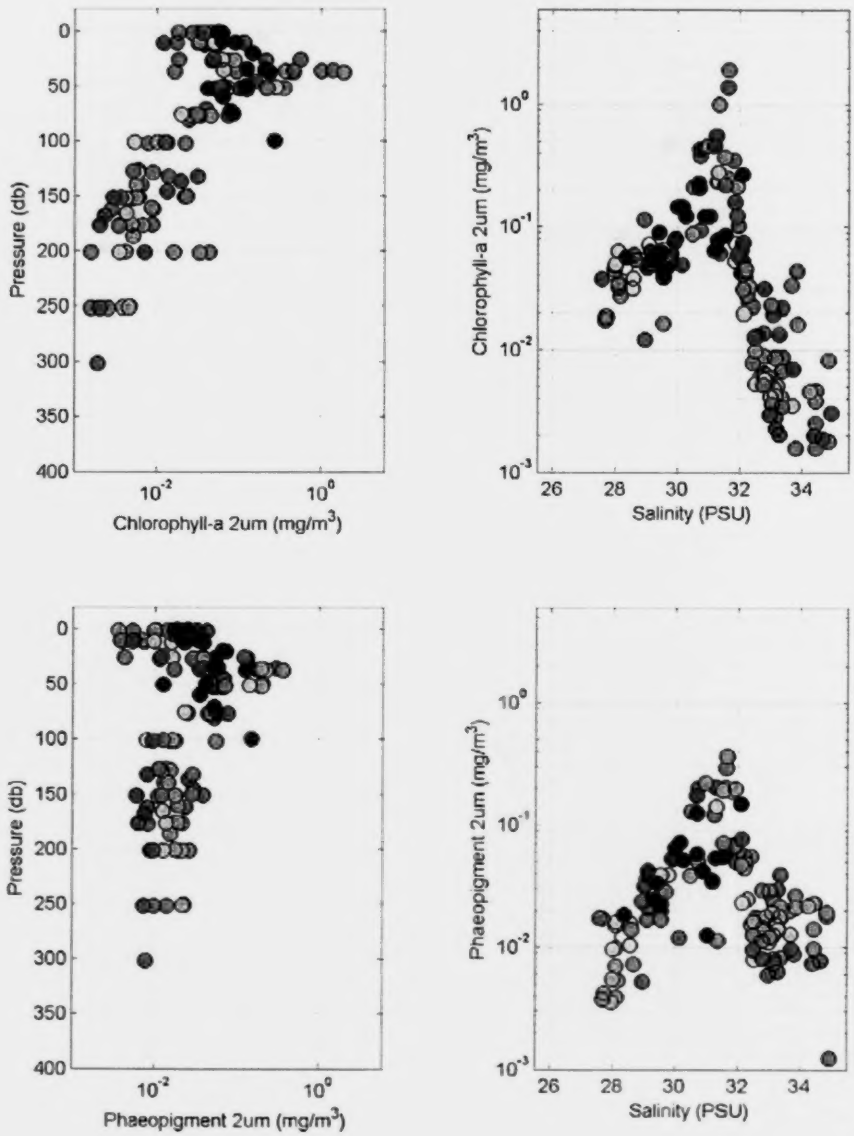
2003-21 Western Canda Basin (145 to 160°W), Property: Chl-a, Phaeo



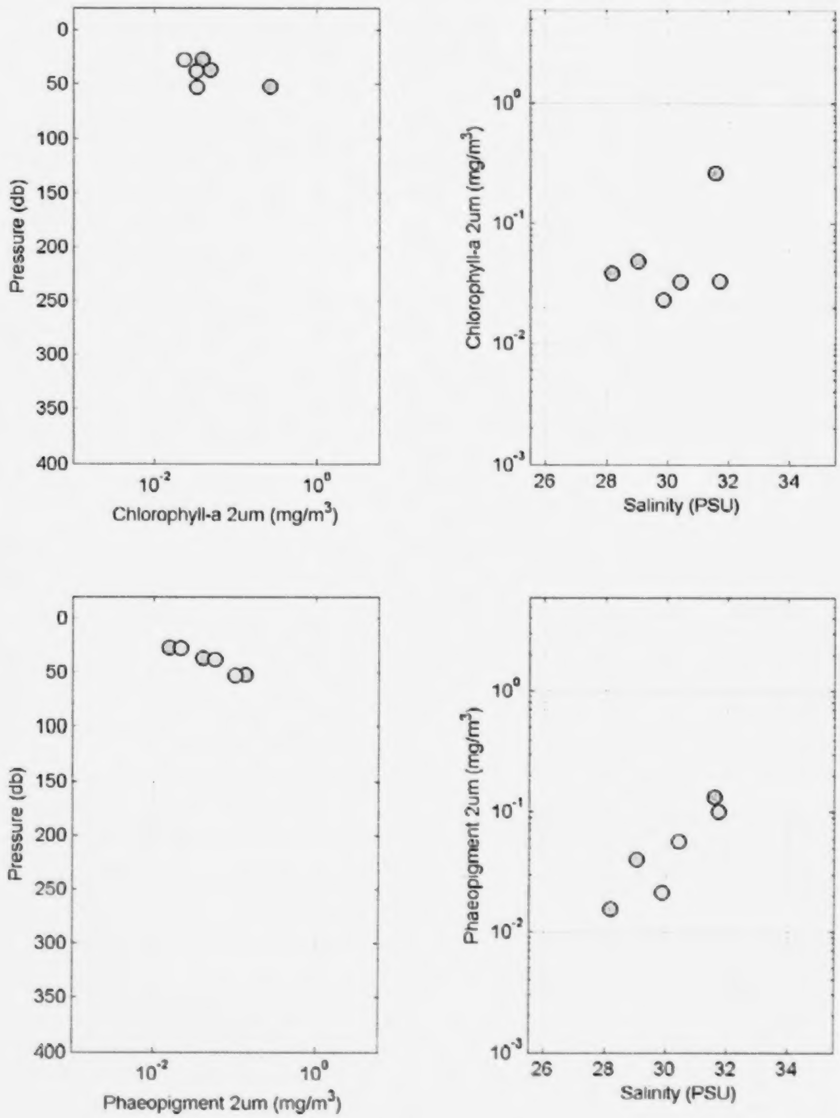
2003-21 Group: East of 145°W, Property: Chlorophyll-a, Phaeopigment



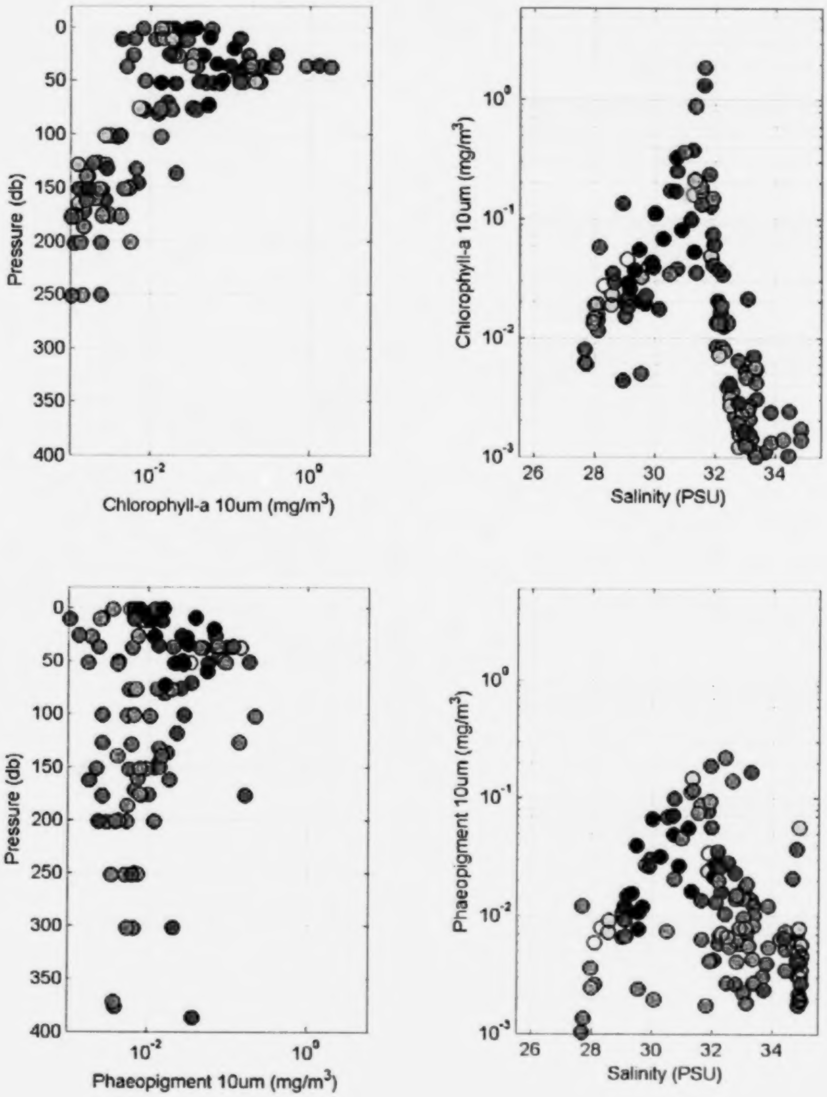
2003-21 Western Canda Basin (145 to 160°W), Property: Chl-a, Phaeo, 2um Size Fractionation



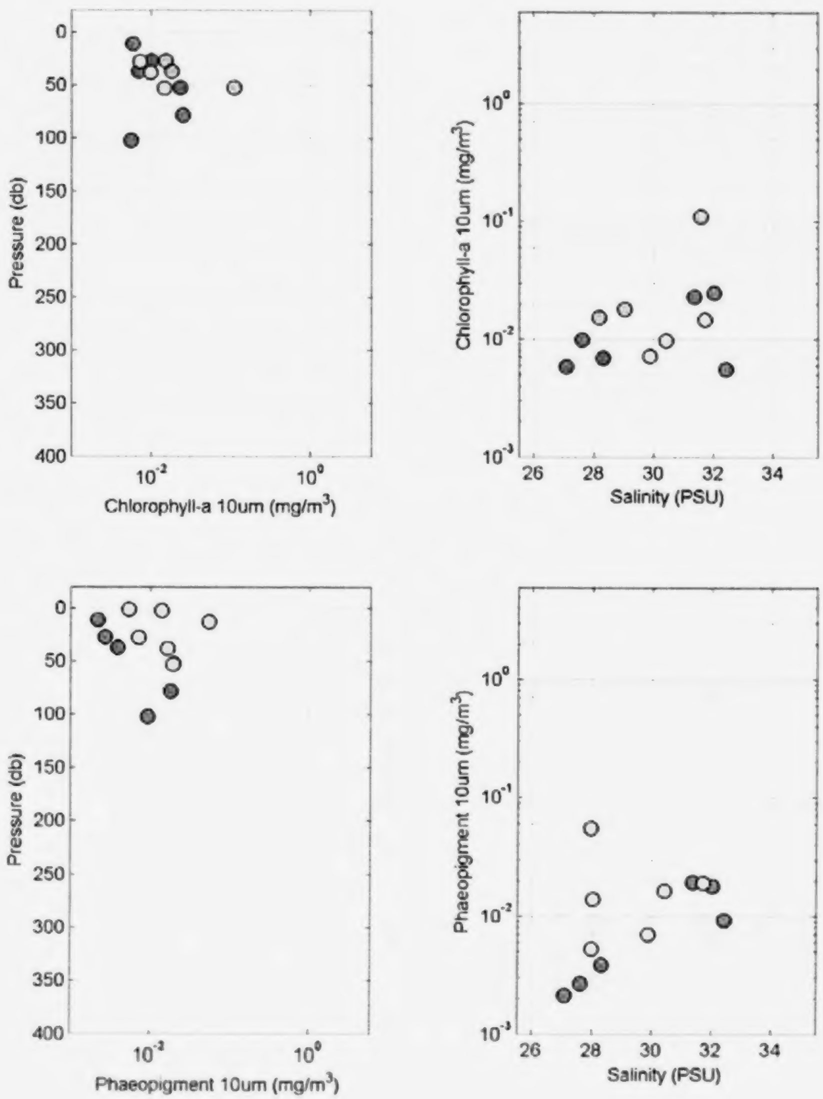
2003-21 Eastern Canada Basin (East of 145°W), Property: Chl-a, Phaeo, 2um Size Fractionation



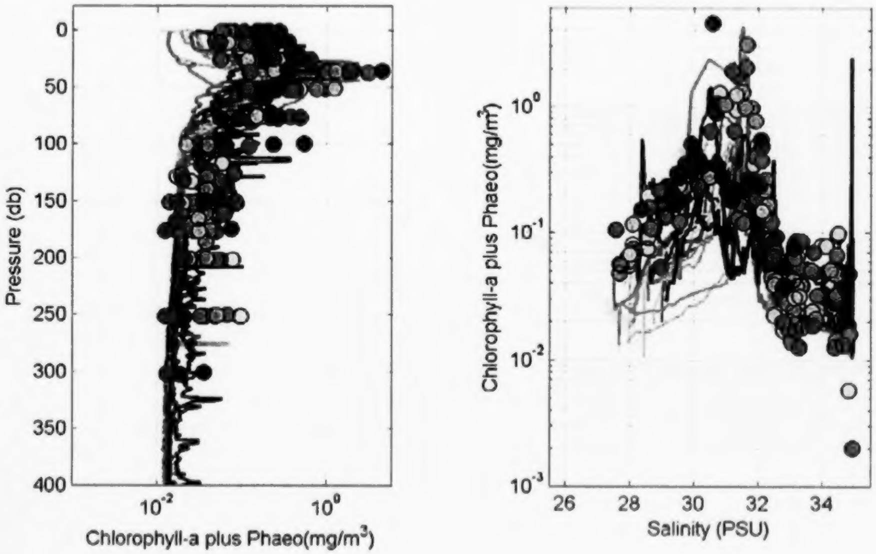
2003-21 Western Canda Basin (145 to 160°W), Property: Chl-a, Phaeo, 10um Size Fractionation



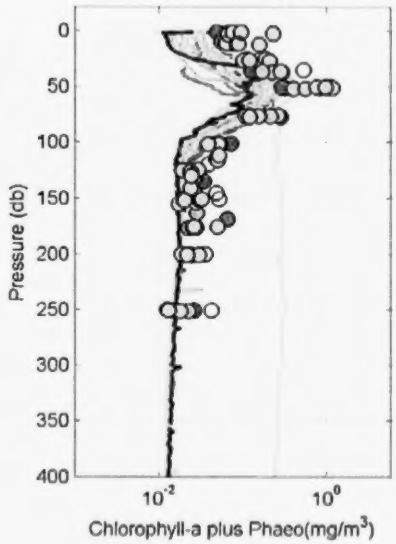
2003-21 Eastern Canada Basin (East of 145°W), Property: Chl-a, Phaeo, 10um Size Fractionation

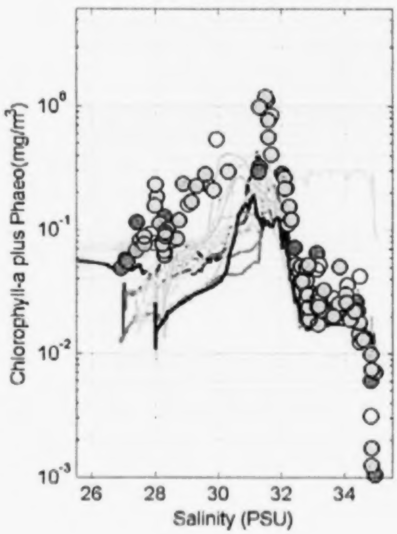


2003-21 Western Canda Basin (145 to 160°W), Property: Combined Chl-a and Phaeo

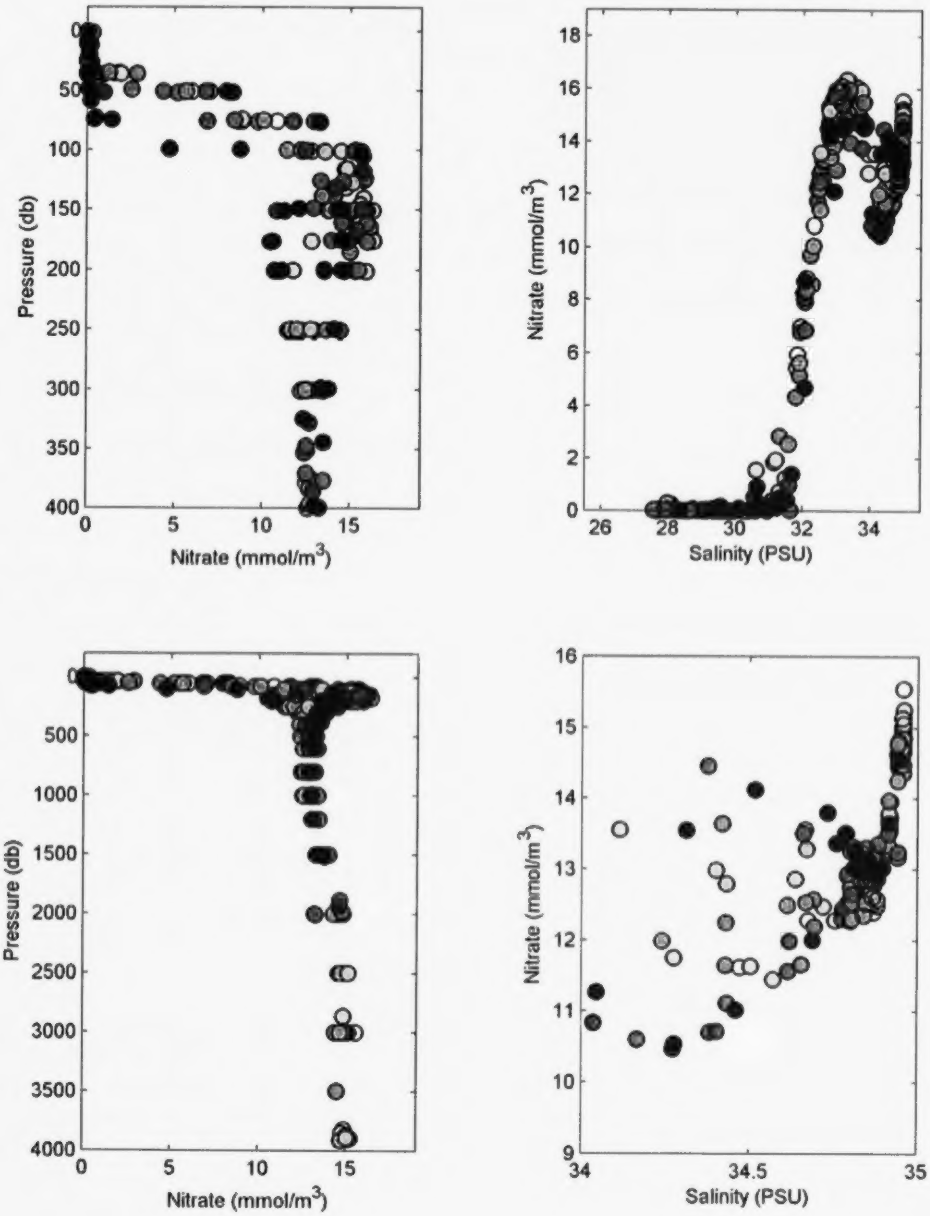


2003-21 Group: East of 145°W, Property: Combined Chlorophyll-a and Phaeopigment

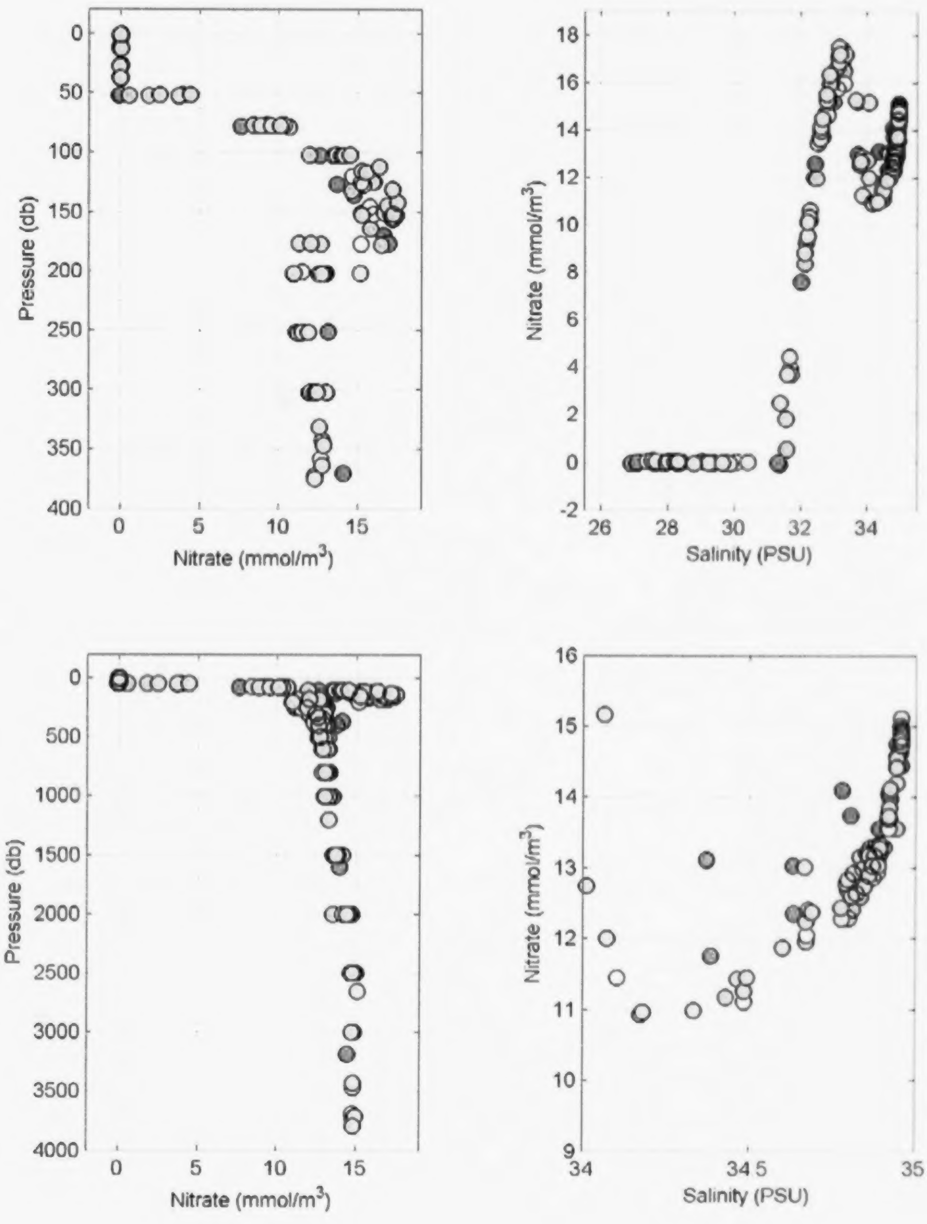




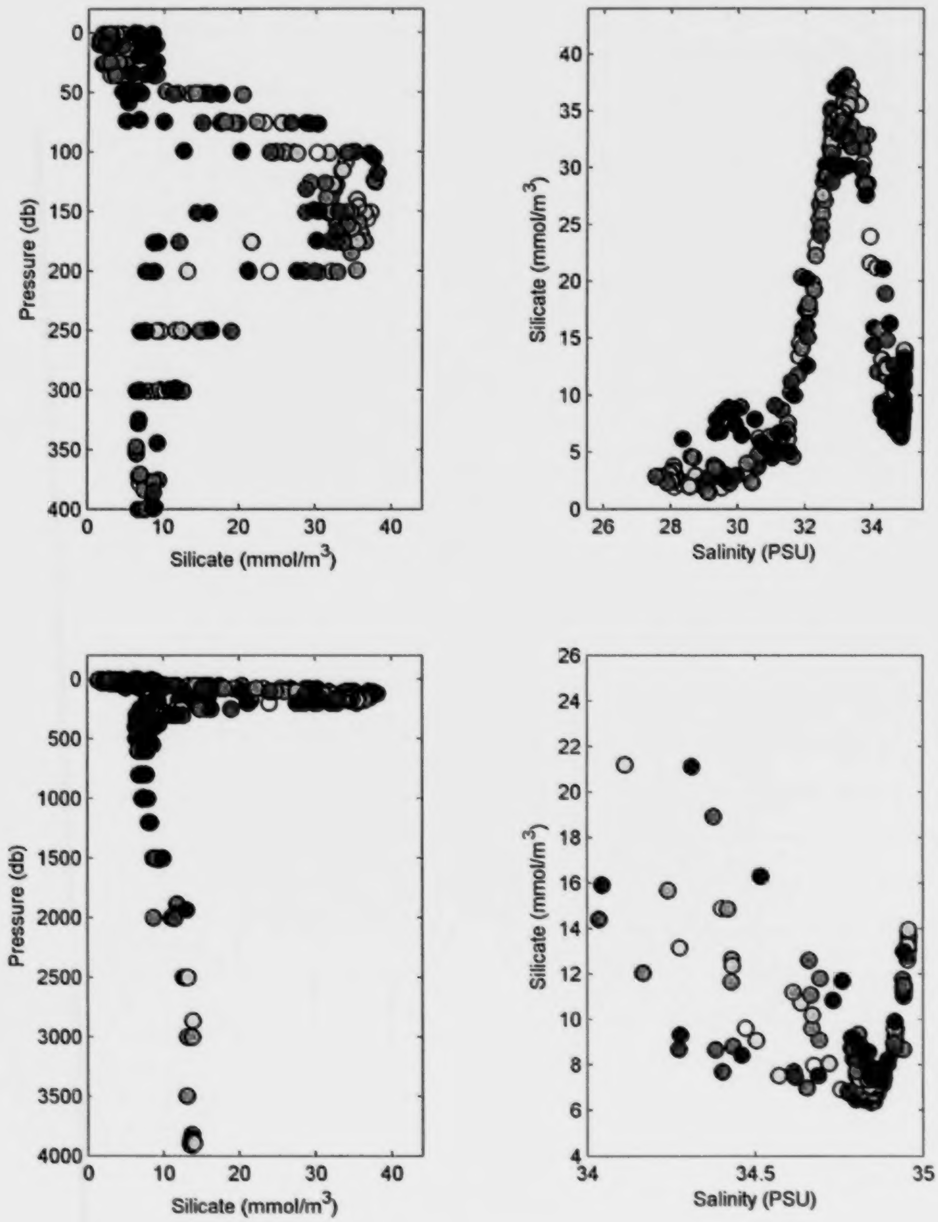
2003-21 Western Canada Basin (145 to 160°W), Property: Nitrate and Nitrite



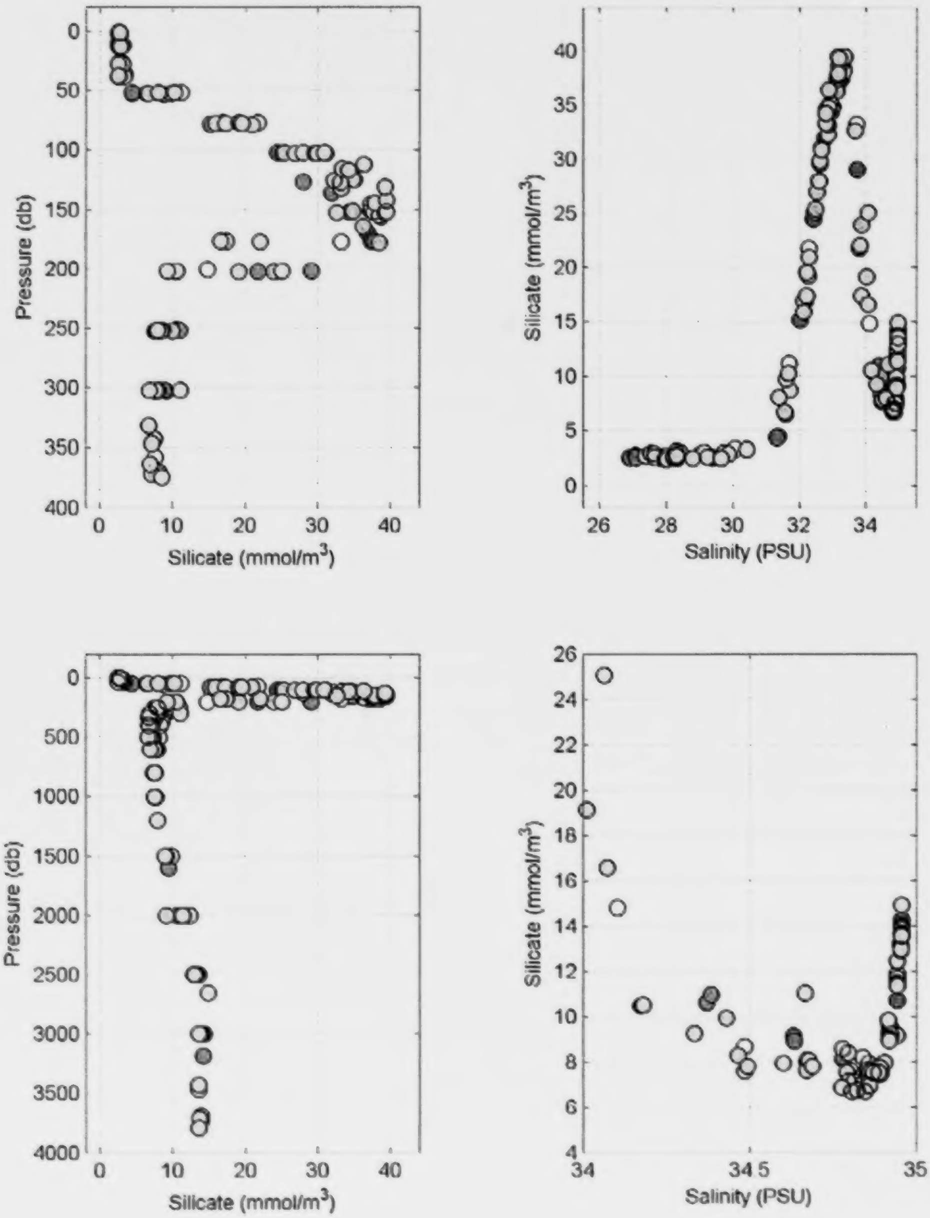
2003-21 Eastern Canada Basin (East of 145°W), Property: Nitrate and Nitrite



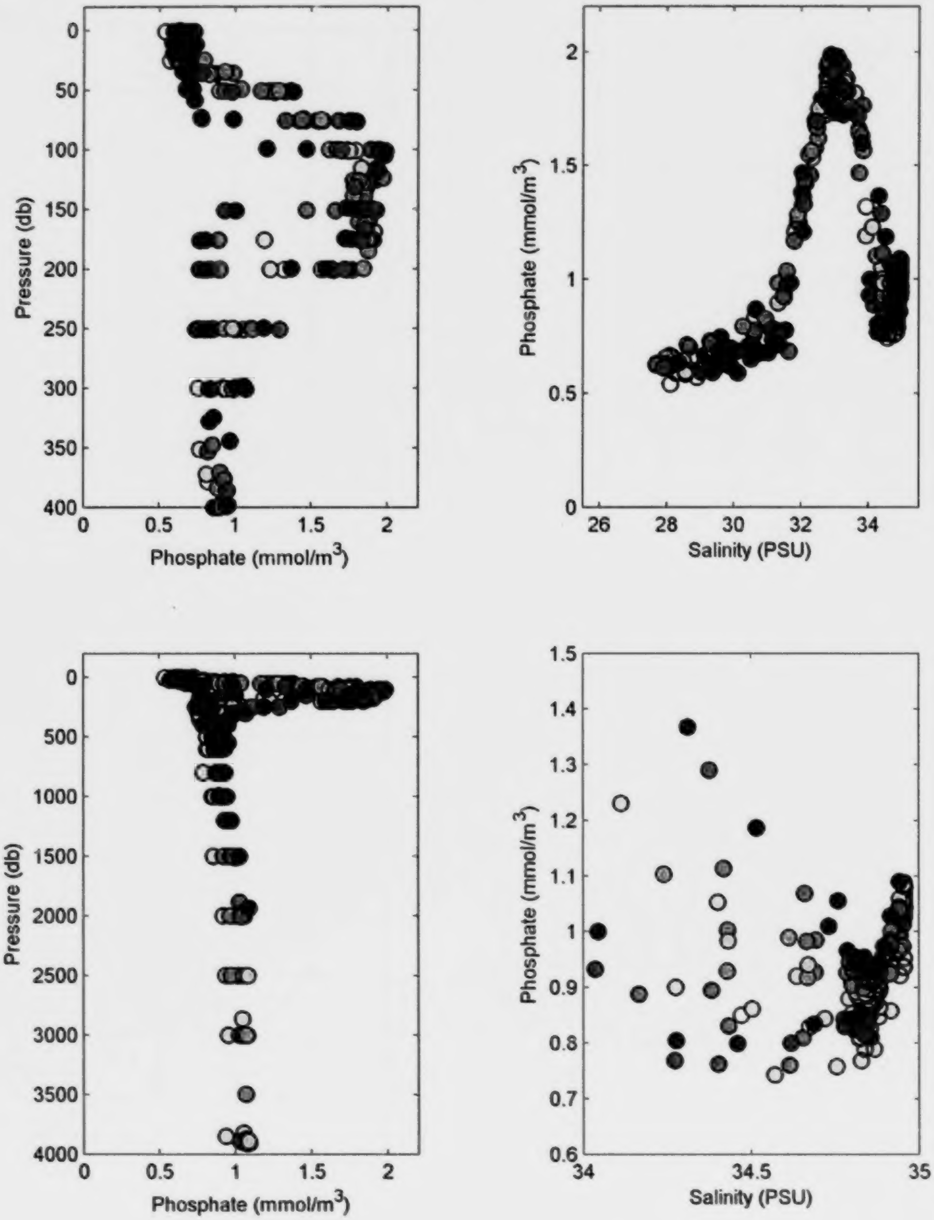
2003-21 Western Canada Basin (145 to 160°W), Property: Silicate



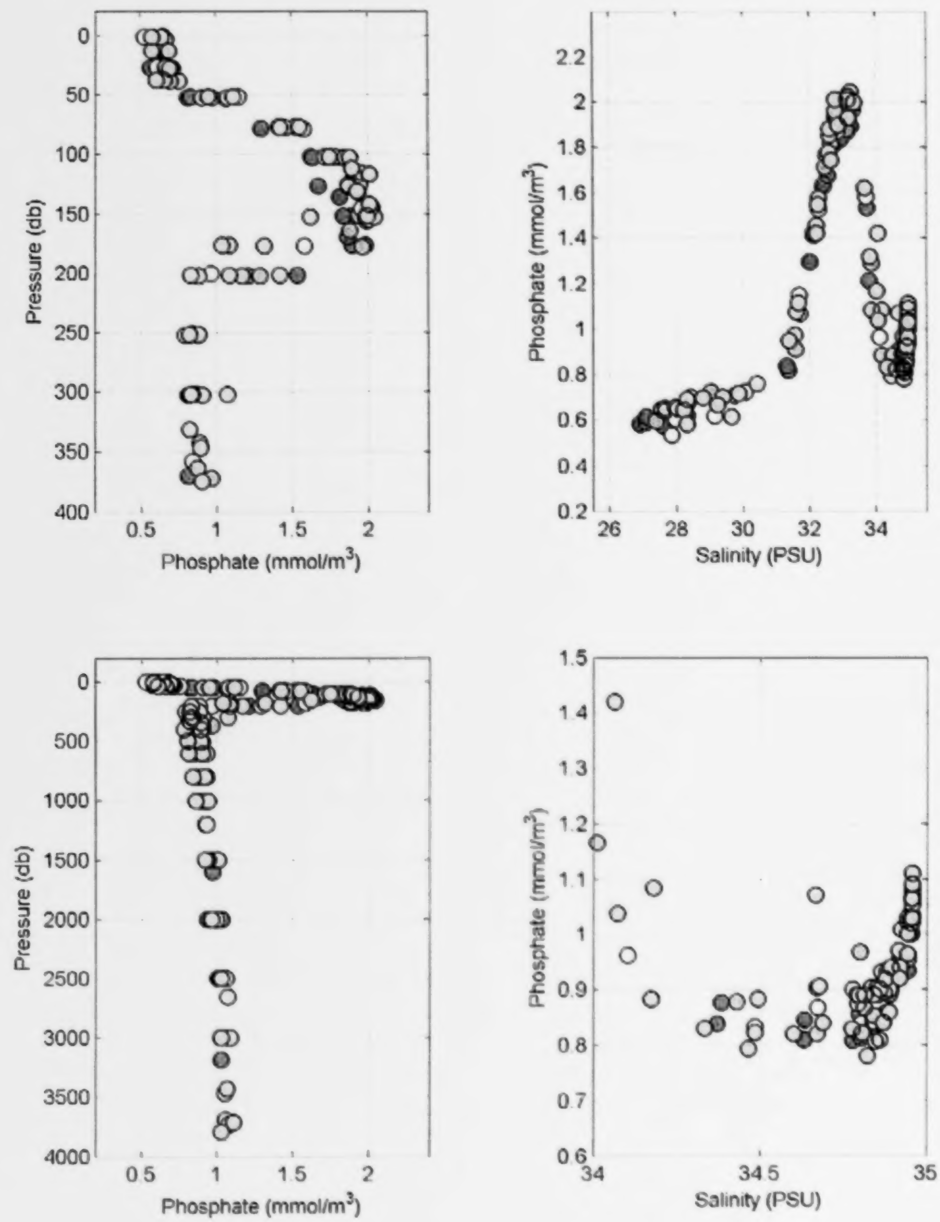
2003-21 Eastern Canada Basin (East of 145°W), Property: Silicate



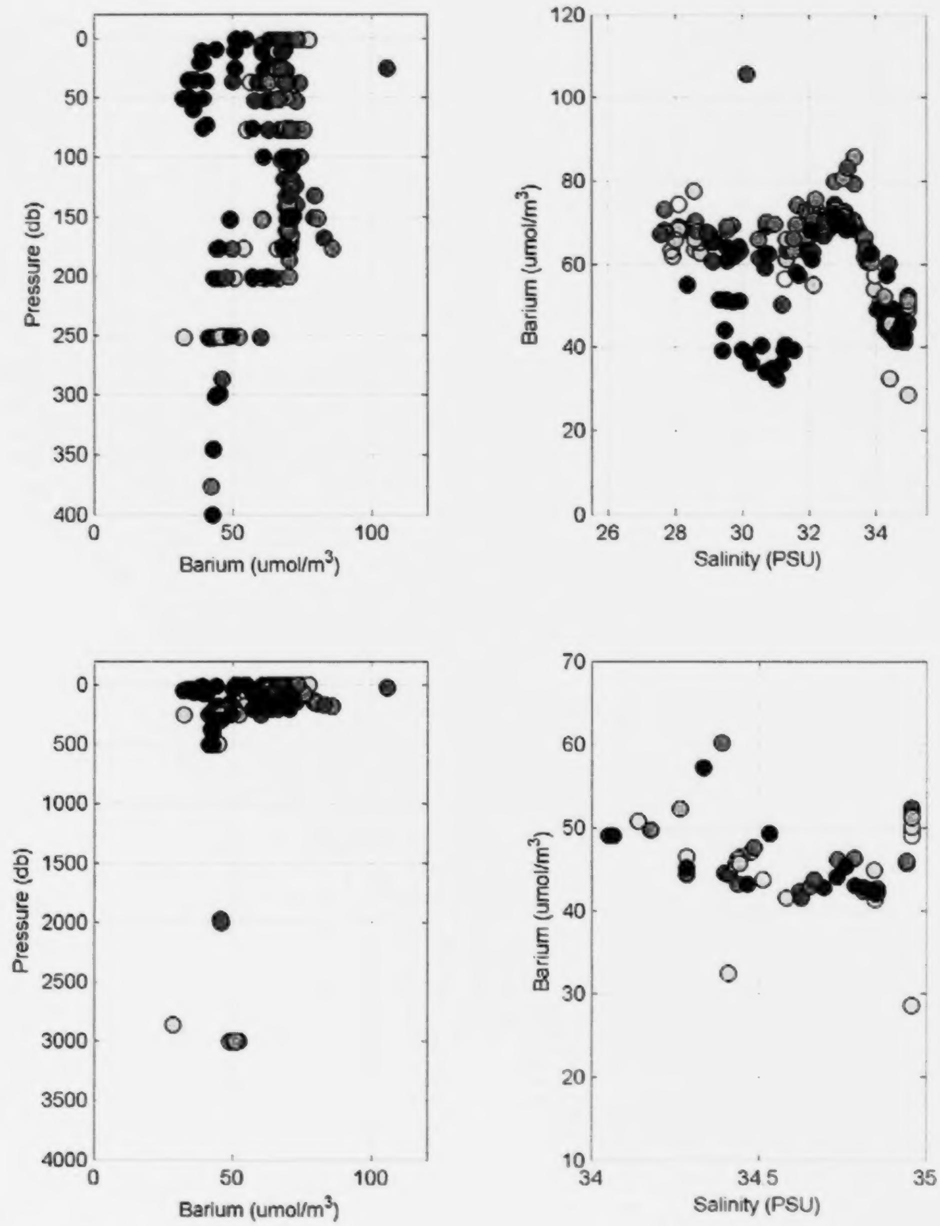
2003-21 Western Canada Basin (145 to 160°W), Property: Phosphate



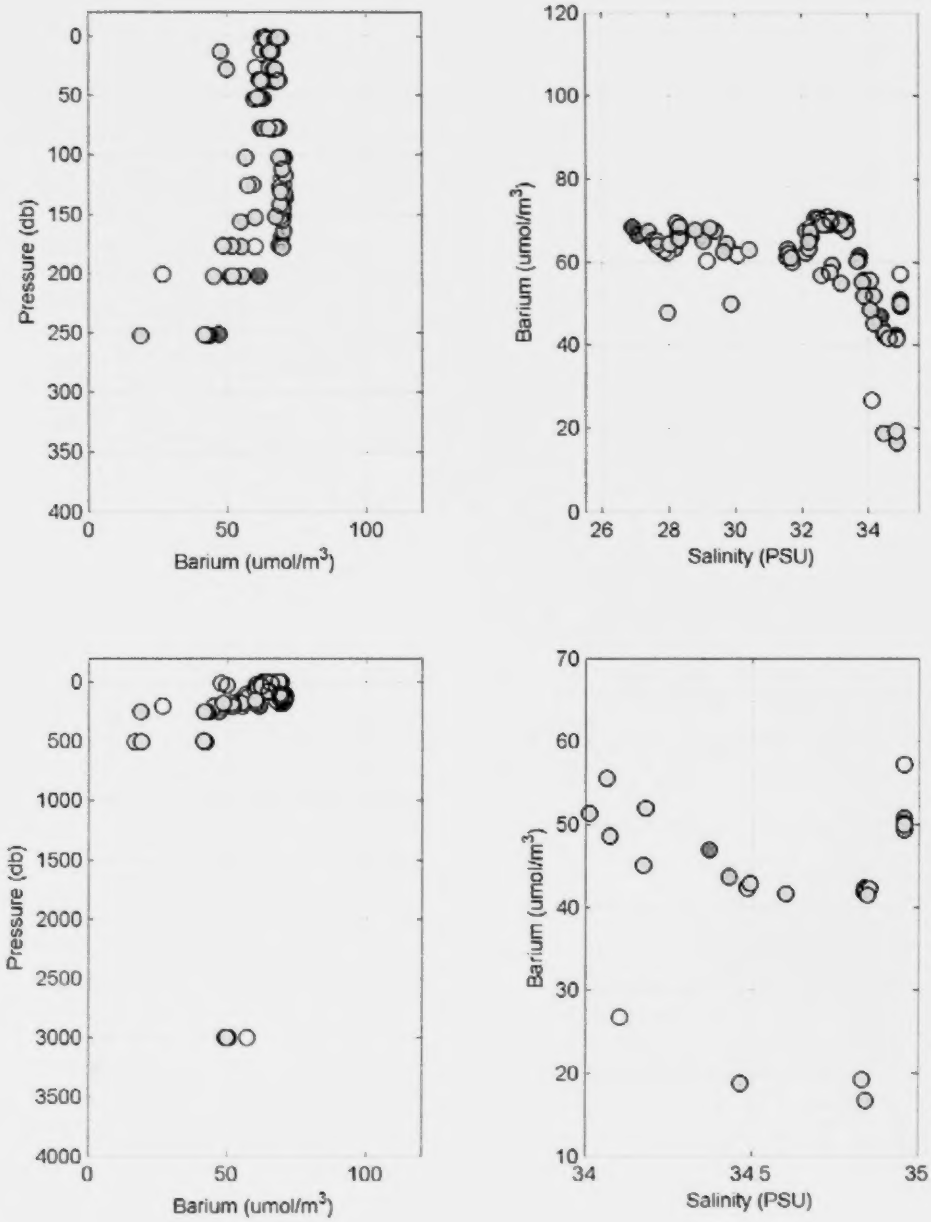
2003-21 Eastern Canada Basin (East of 145°W), Property: Phosphate



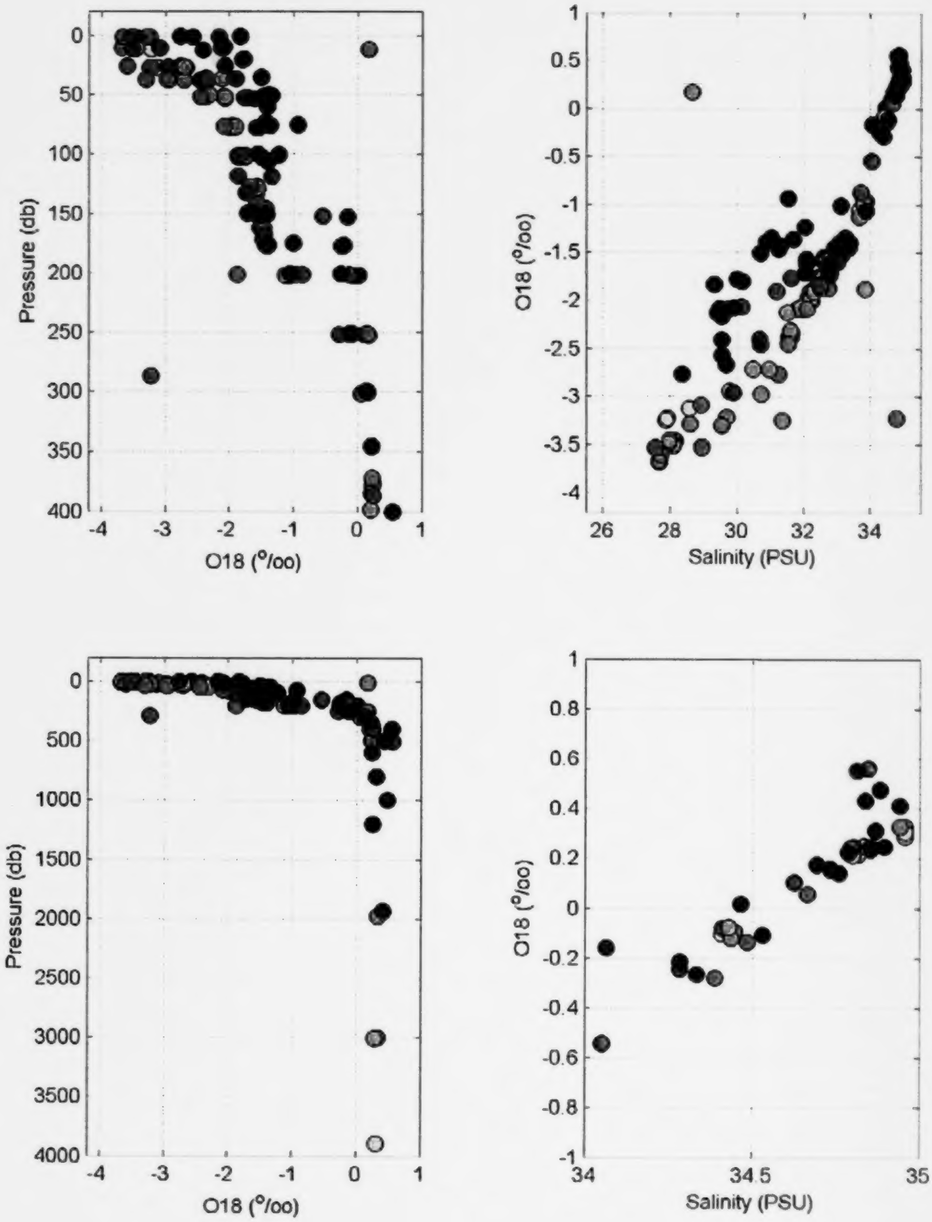
2003-21 Western Canda Basin (145 to 160°W), Property: Barium



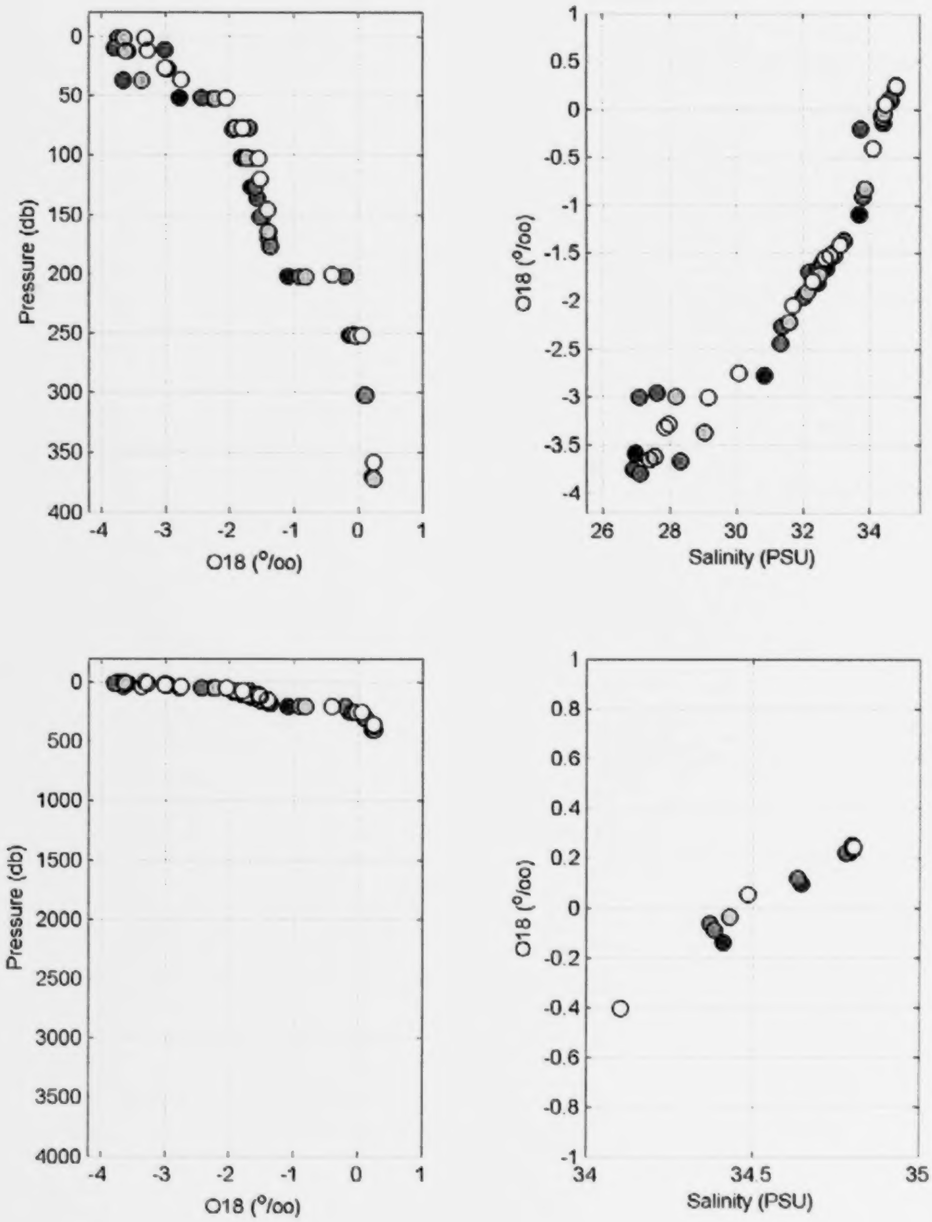
2003-21 Eastern Canada Basin (East of 145°W), Property: Barium



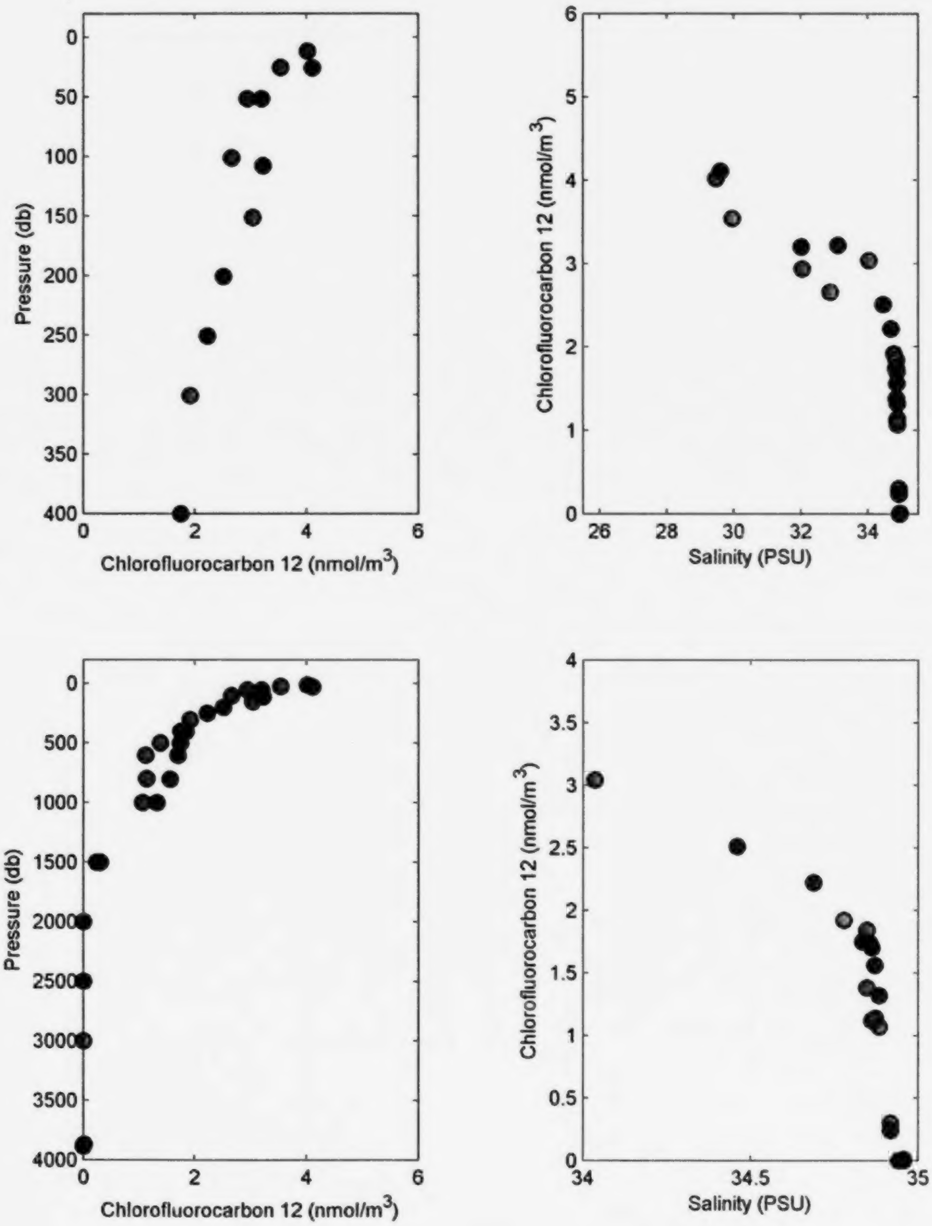
2003-21 Western Canda Basin (145 to 160°W), Property: O18



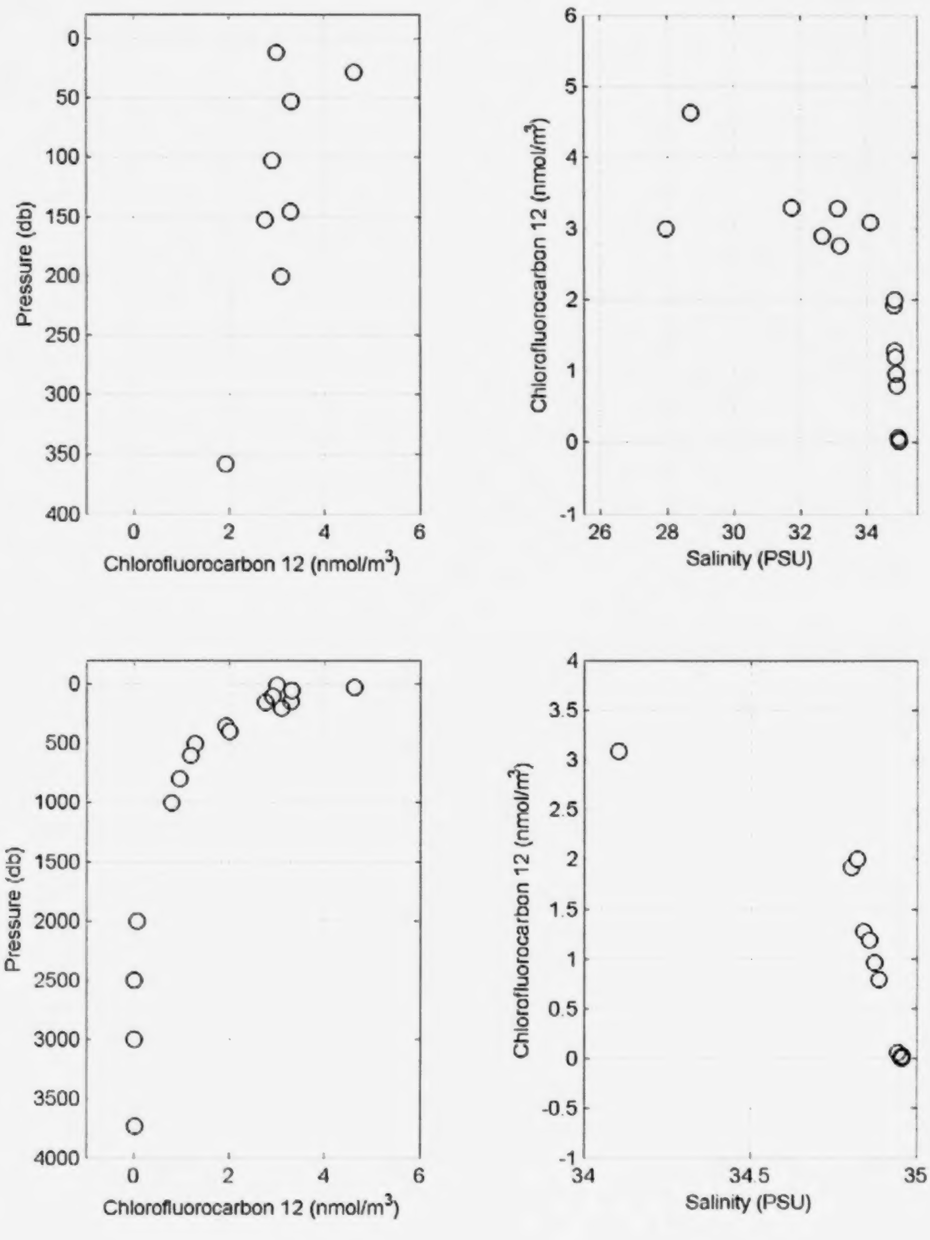
2003-21 Eastern Canada Basin (East of 145°W), Property: O18



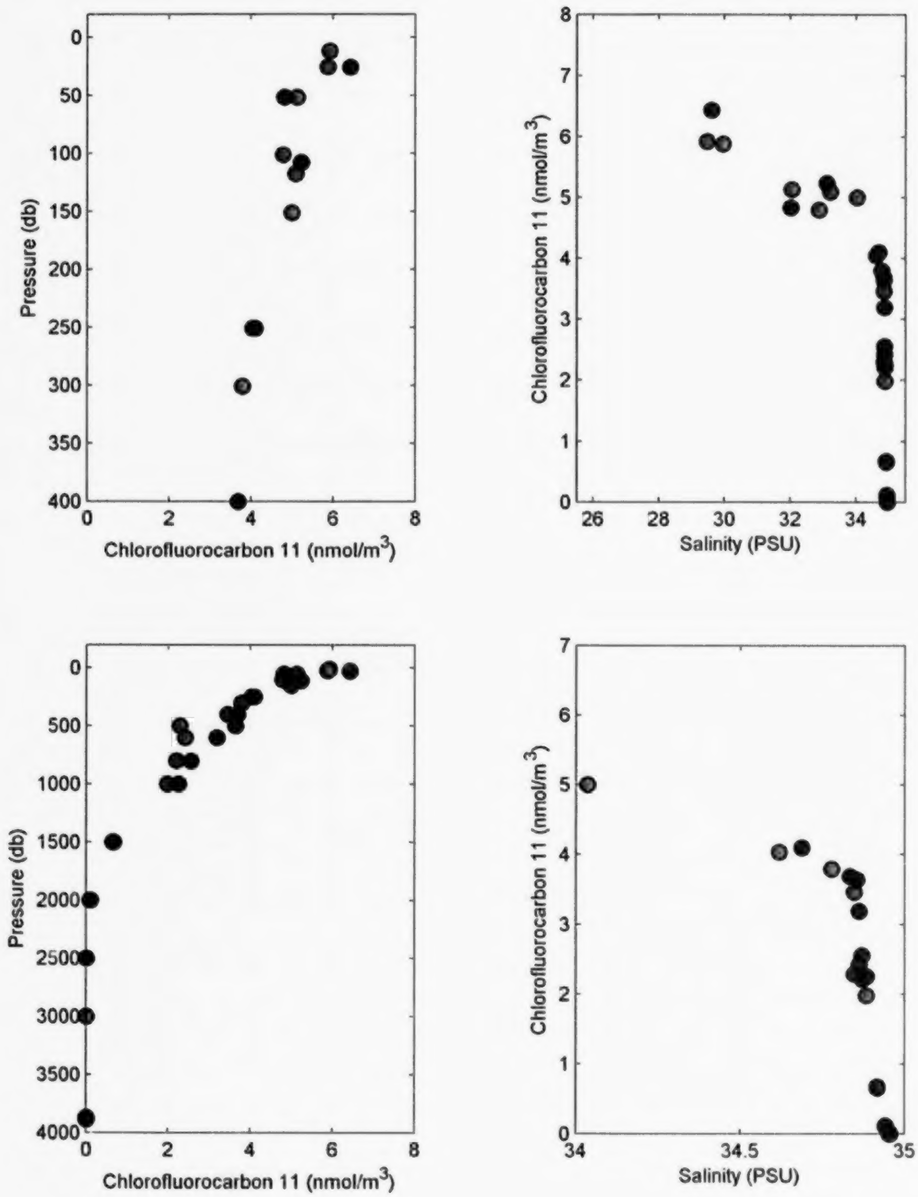
2003-21 Western Canada Basin (145 to 160°W), Property: Chlorofluorcarbon-12



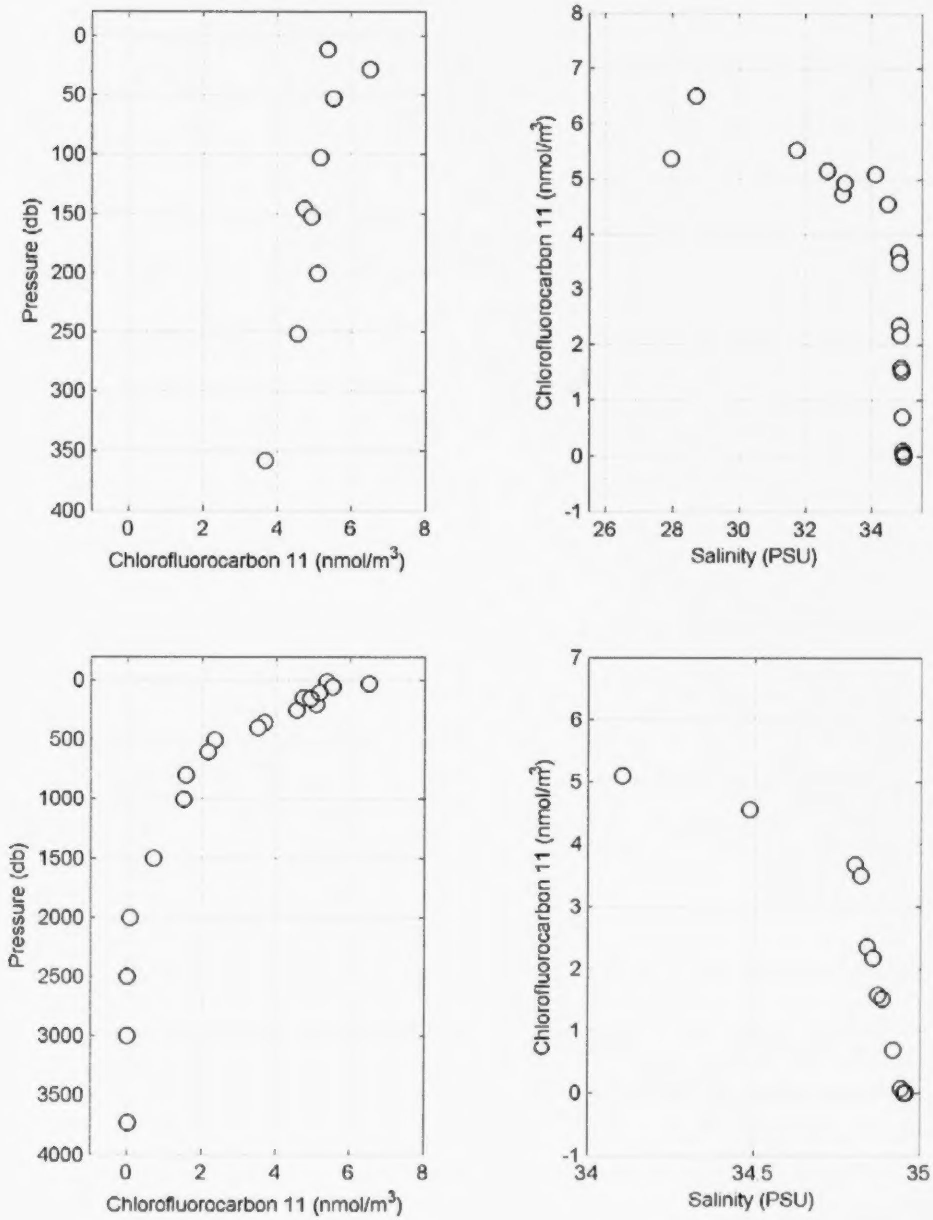
2003-21 Eastern Canada Basin (East of 145°W), Property: Chlorofluorcarbon-12



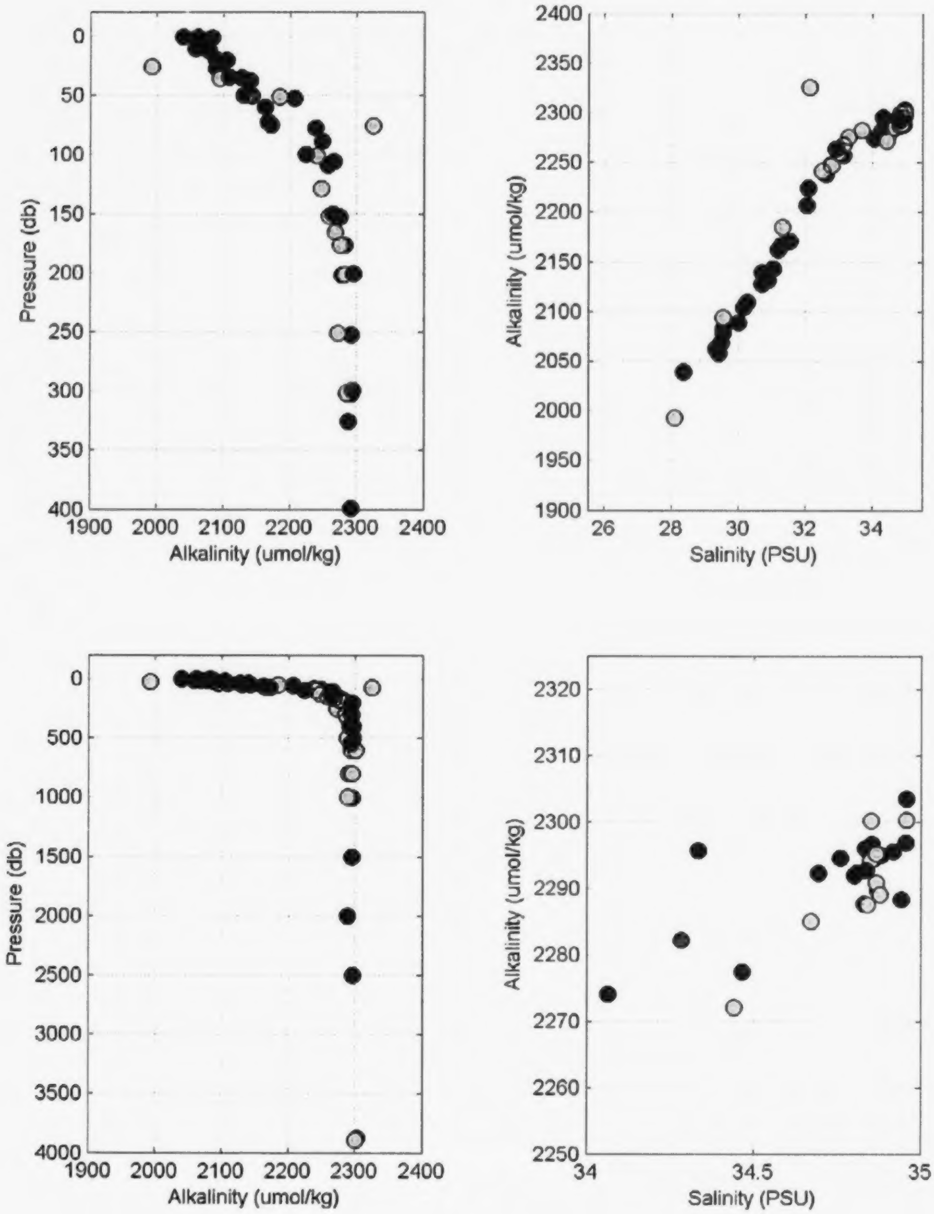
2003-21 Western Canada Basin (145 to 160°W), Property: Chlorofluorcarbon-11



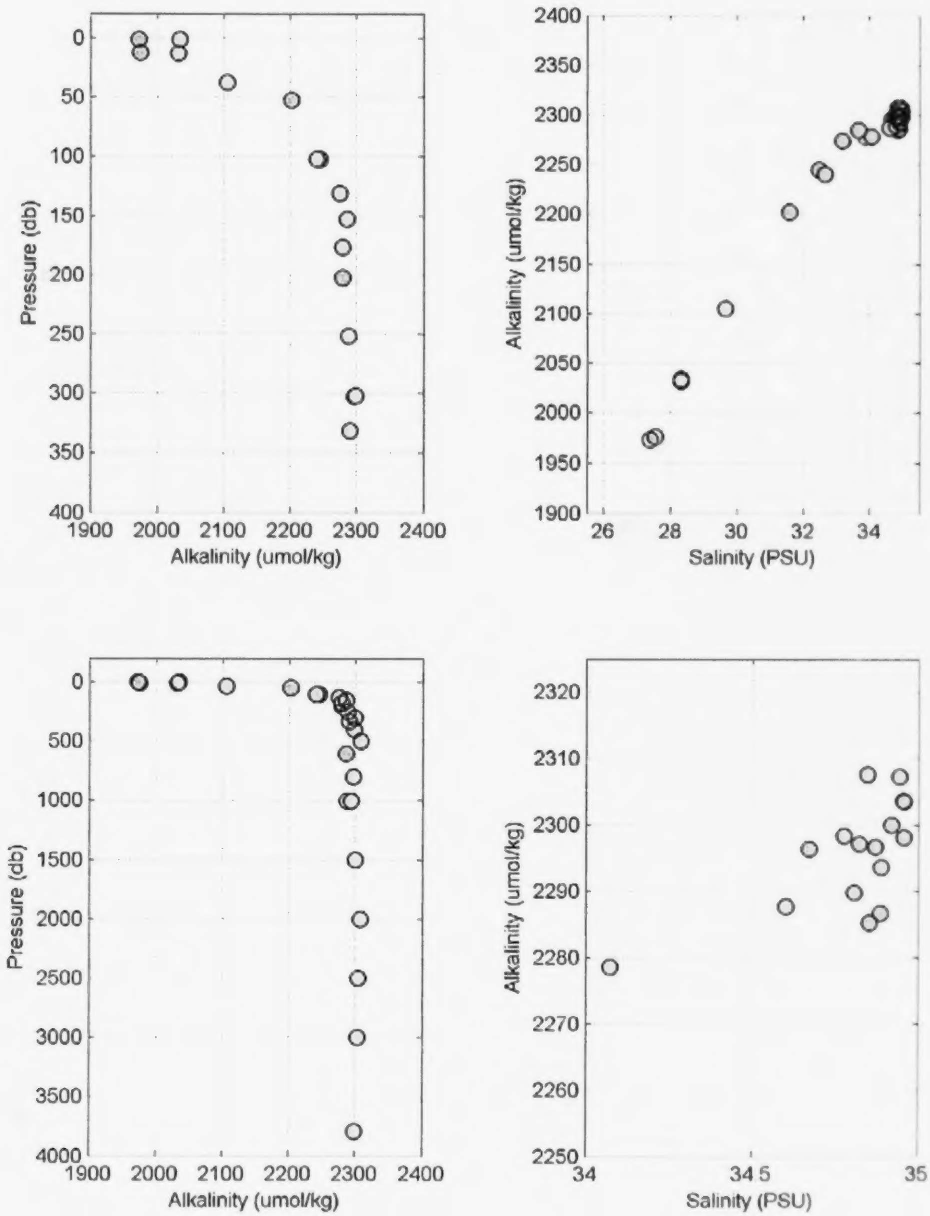
2003-21 Eastern Canada Basin (East of 145°W), Property: Chlorofluorcarbon-11



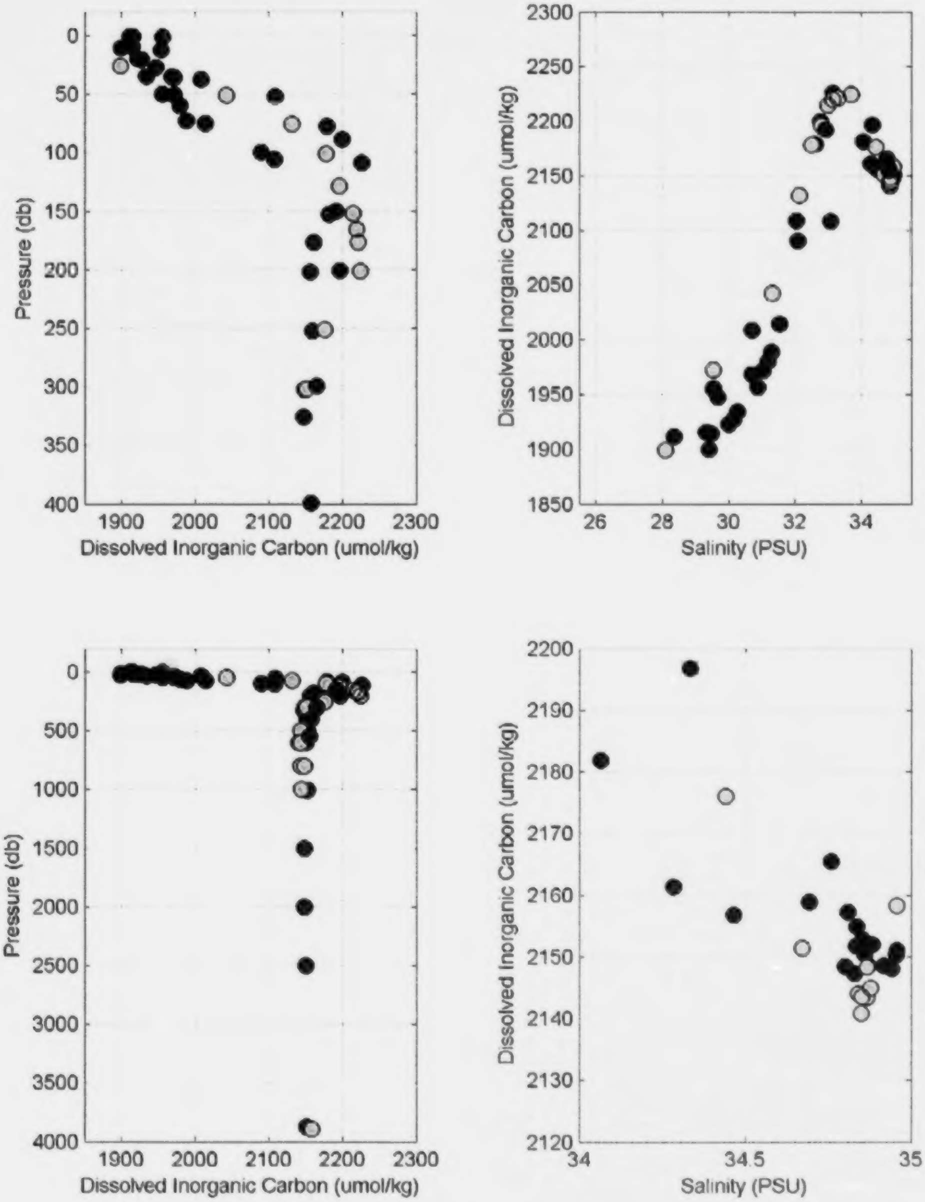
2003-21 Western Canda Basin (145 to 160°W), Property: Alkalinity



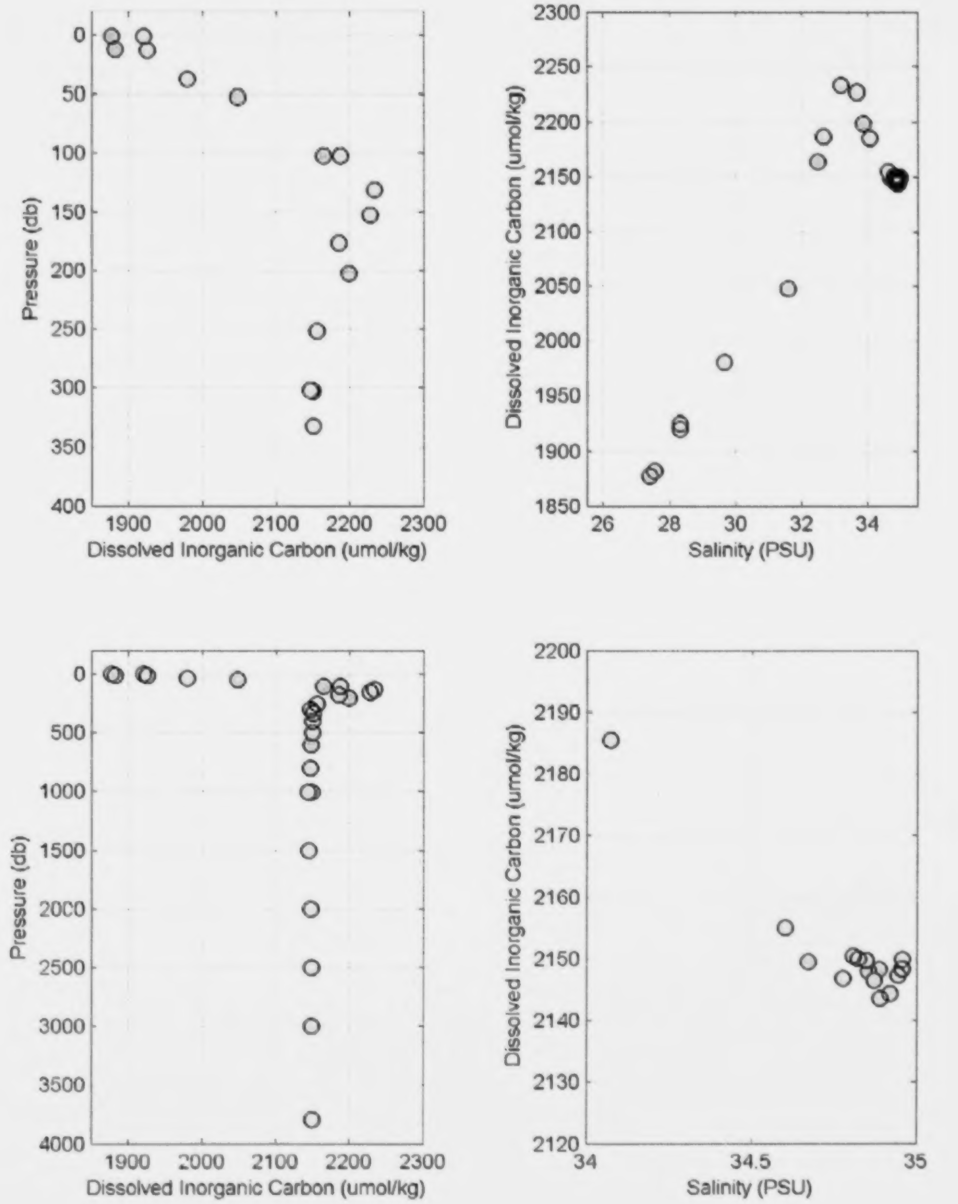
2003-21 Eastern Canada Basin (East of 145°W), Property: Alkalinity



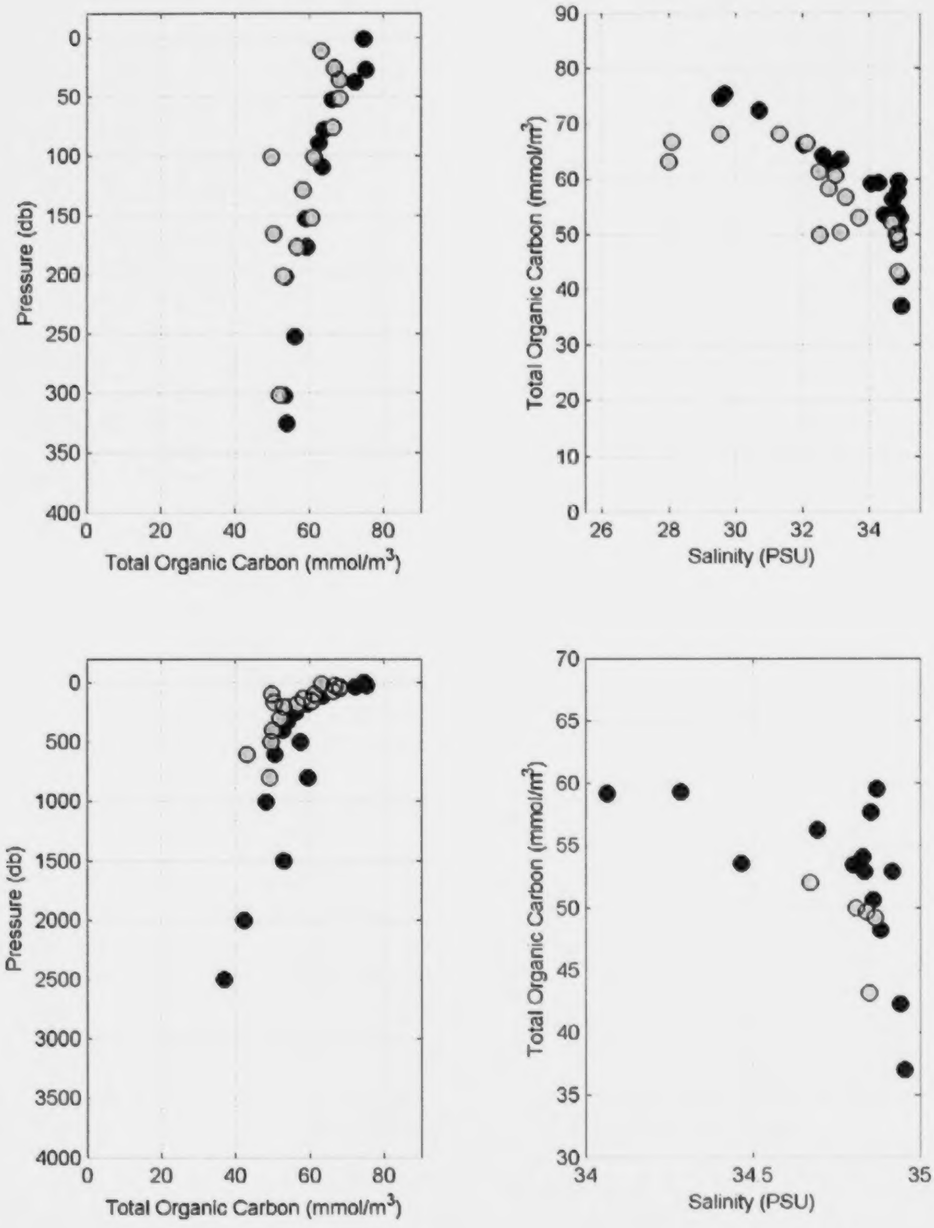
2003-21 Western Canda Basin (145 to 160°W), Property: Dissolved Inorganic Carbon



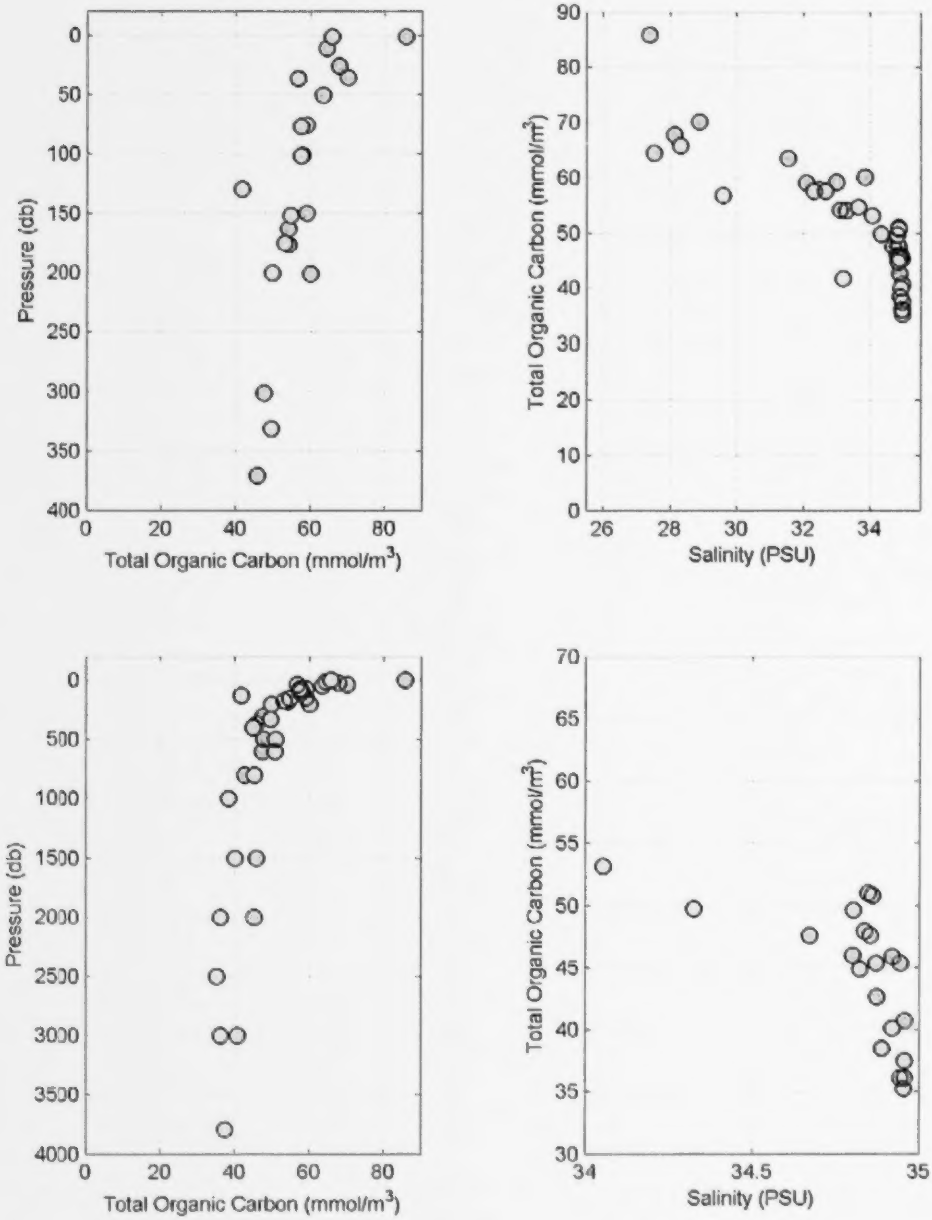
2003-21 Eastern Canada Basin (East of 145°W), Property: Dissolved Inorganic Carbon



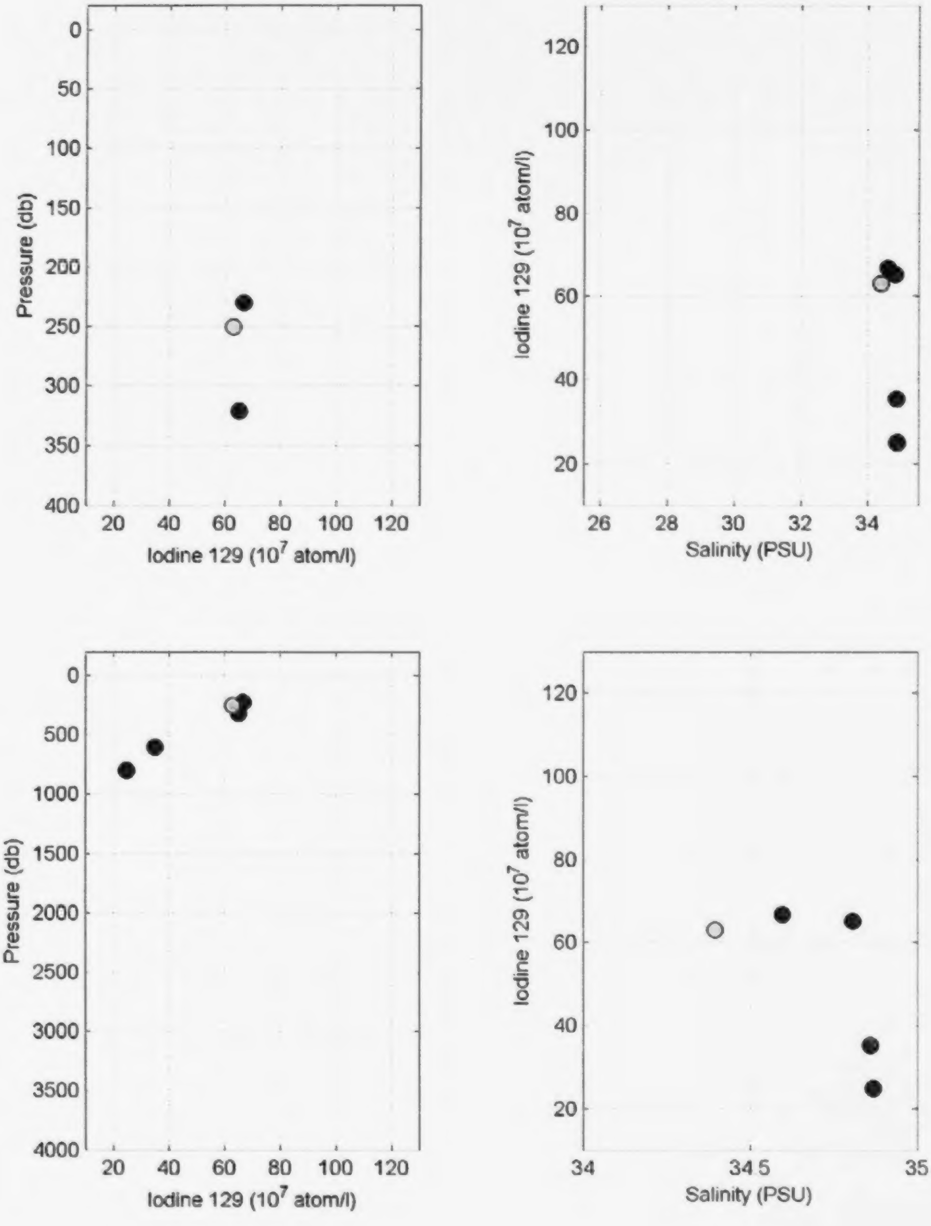
2003-21 Western Canda Basin (145 to 160°W), Property: Total Organic Carbon



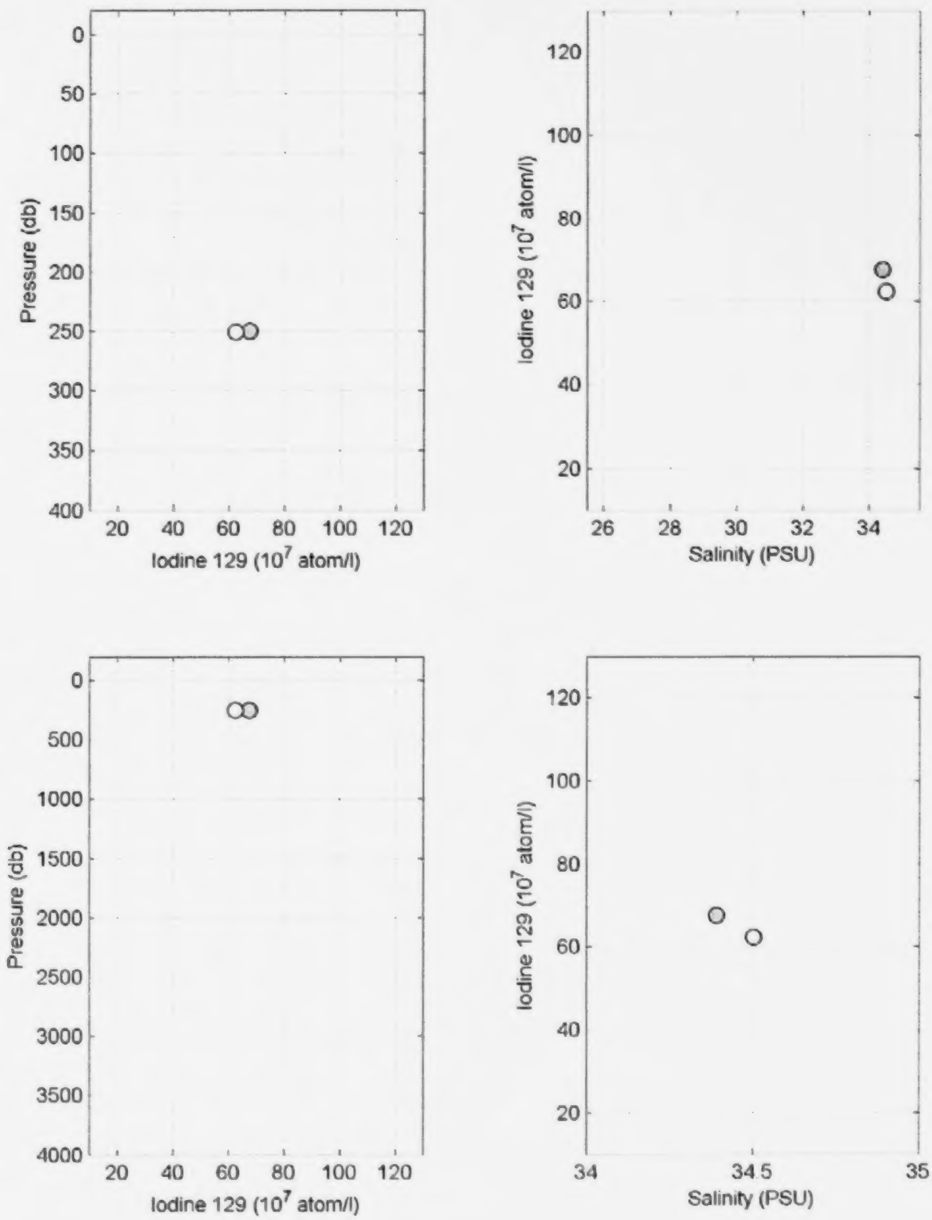
2003-21 Group: East of 145°W, Property: Total Organic Carbon



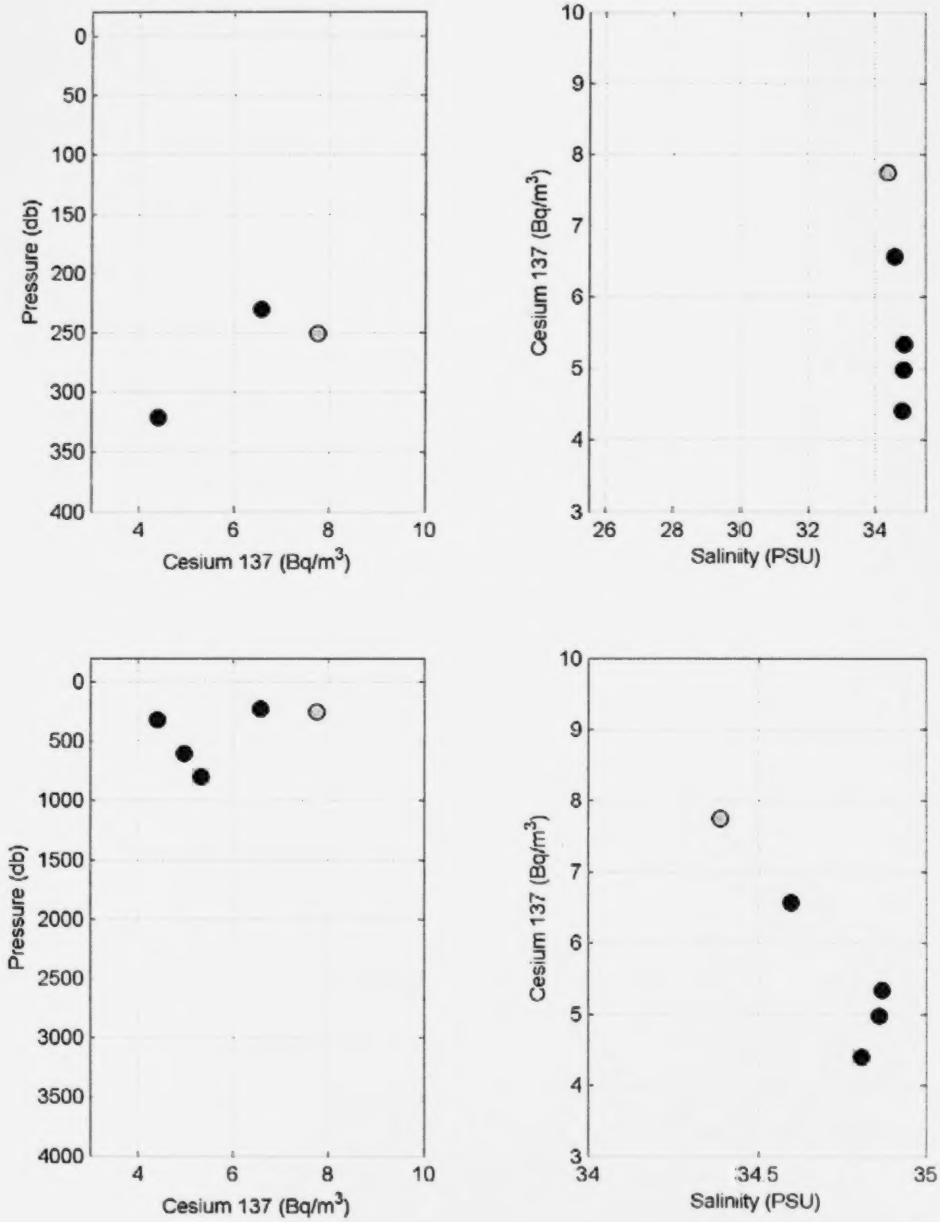
2003-21 Western Canda Basin (145 to 160°W), Property: Iodine-129



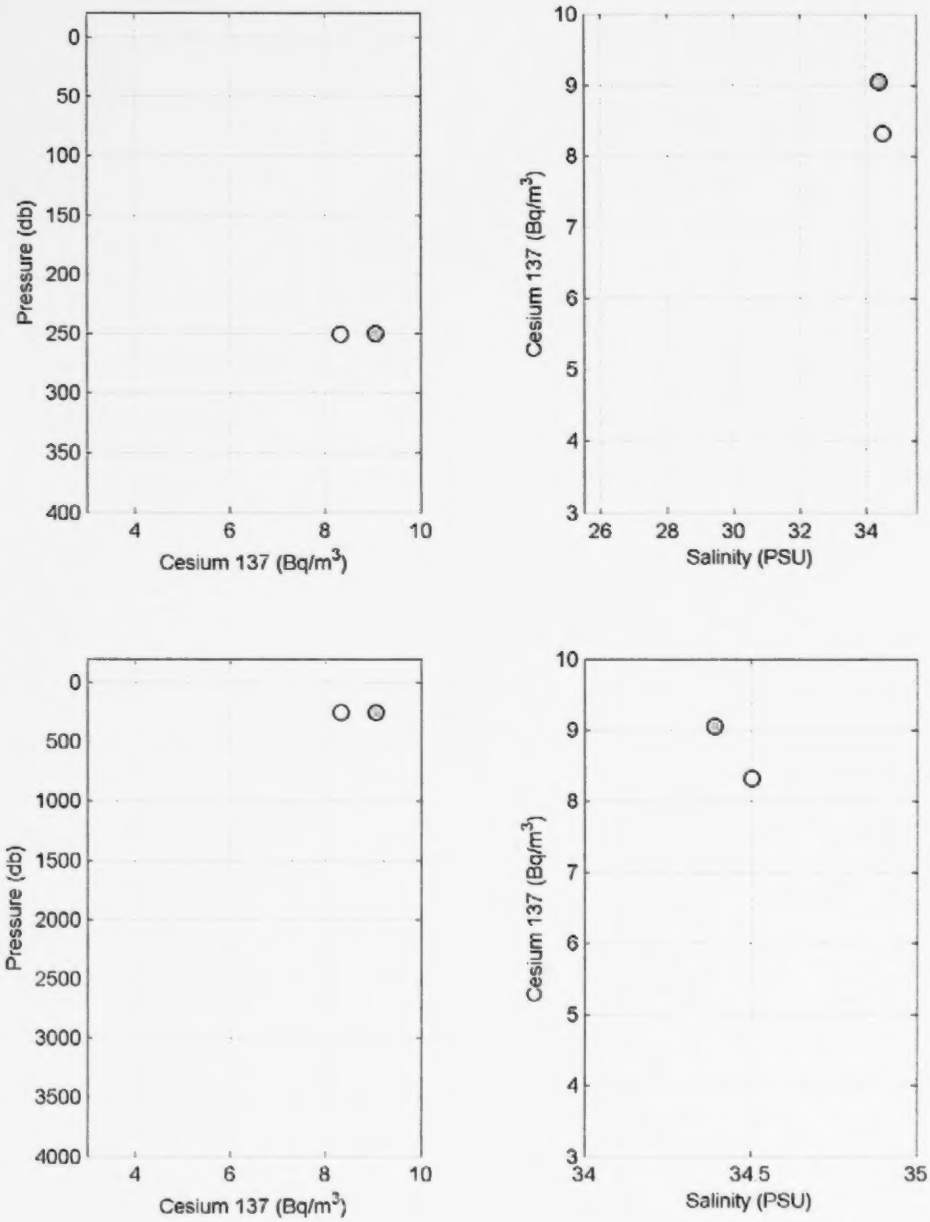
2003-21 Eastern Canada Basin (East of 145°W), Property: Iodine-129



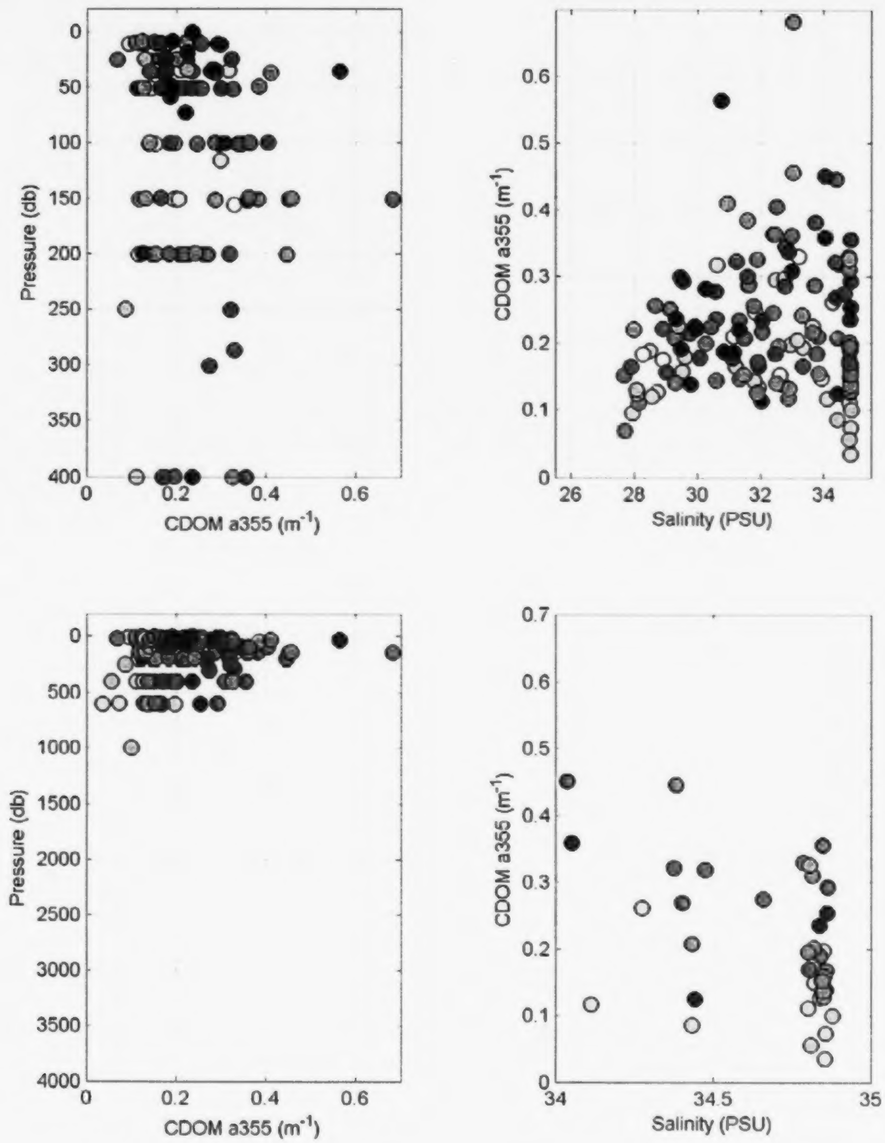
2003-21 Western Canda Basin (145 to 160°W), Property: Cesium-137



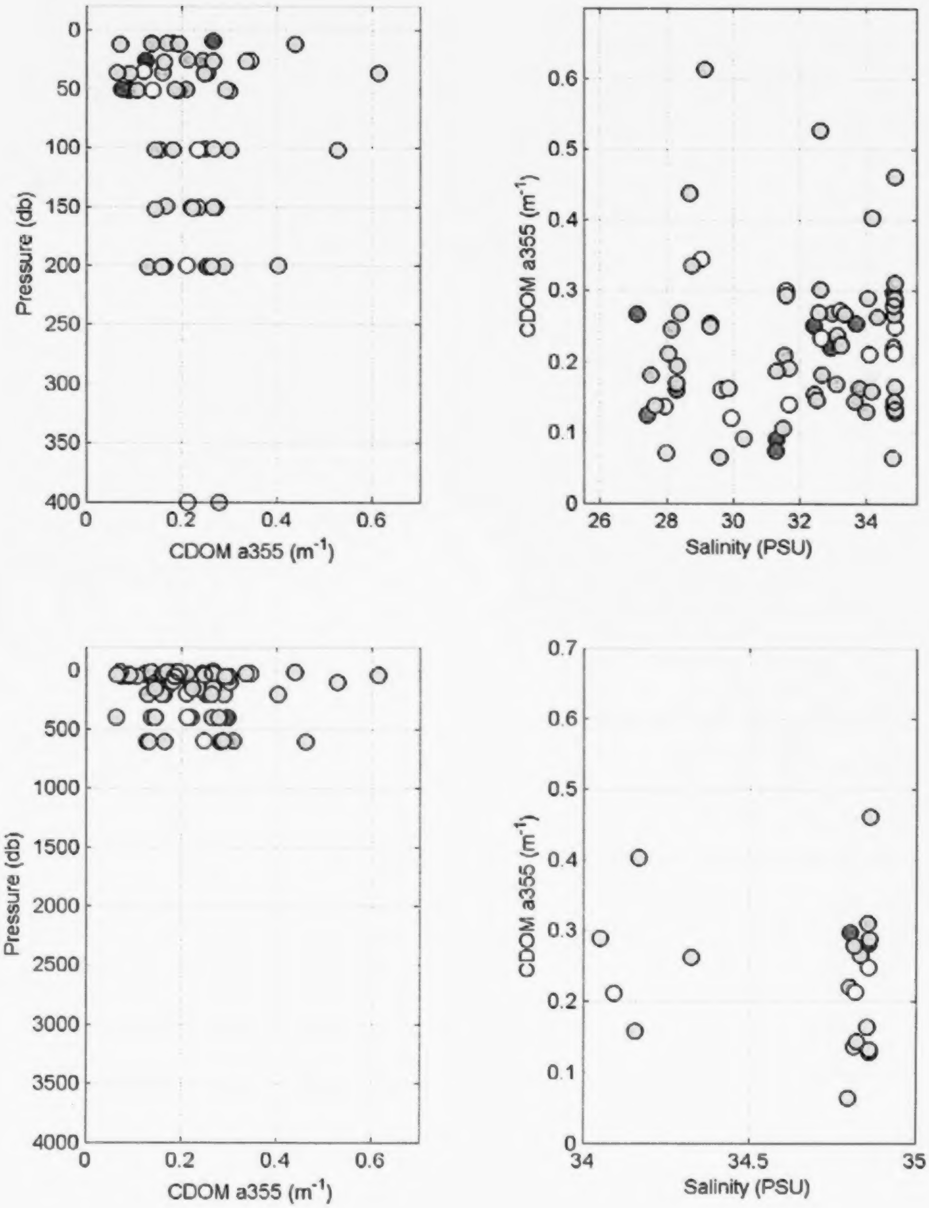
2003-21 Eastern Canada Basin (East of 145°W), Property: Cesium-137



2003-21 Group: West of 145°W, not including West Chukchi Cap, Property: CDOM a355

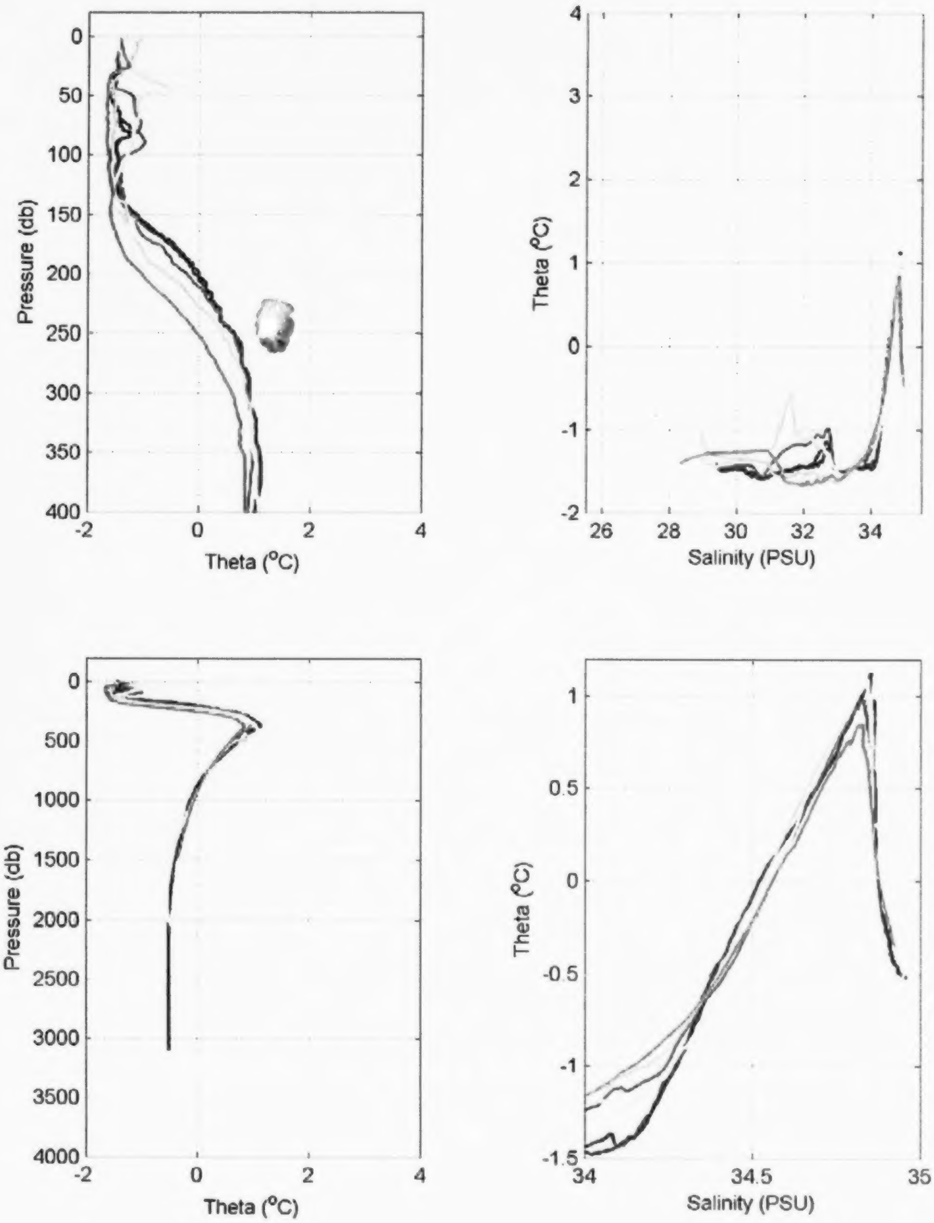


2003-21 Group: East of 145°W, Property: CDOM a355

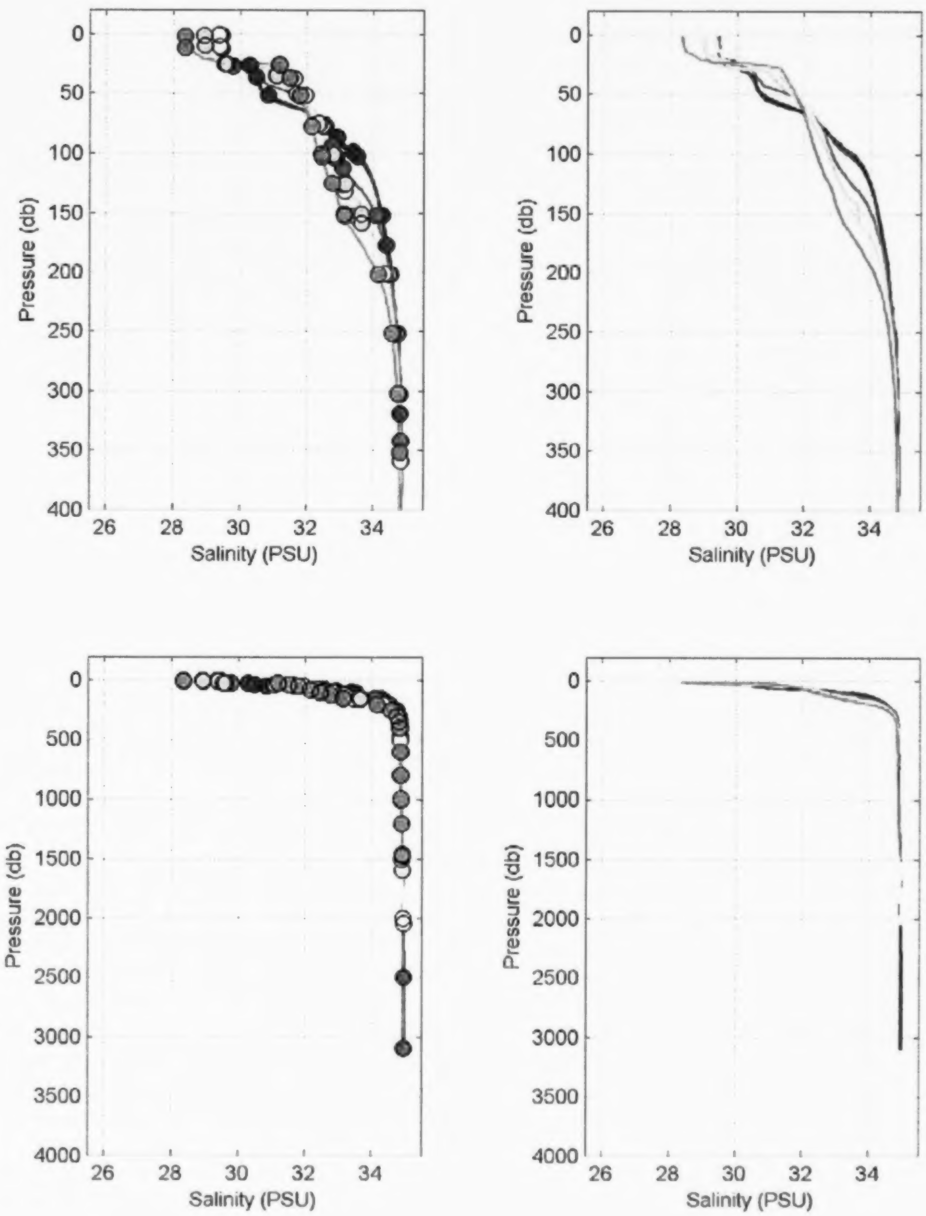


6.2 Chukchi Cap

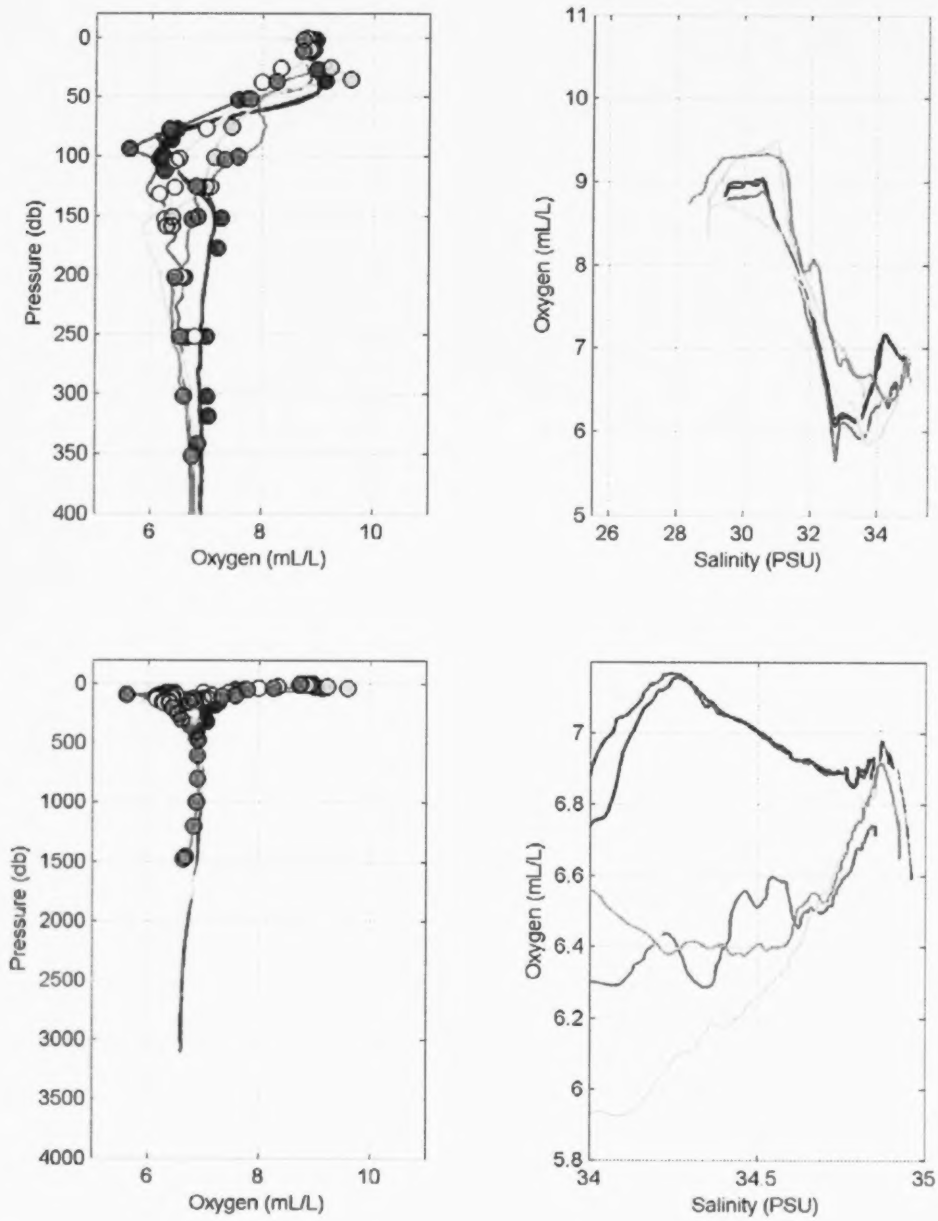
2003-21 Chukchi Cap (West of 160°W), Property: Theta



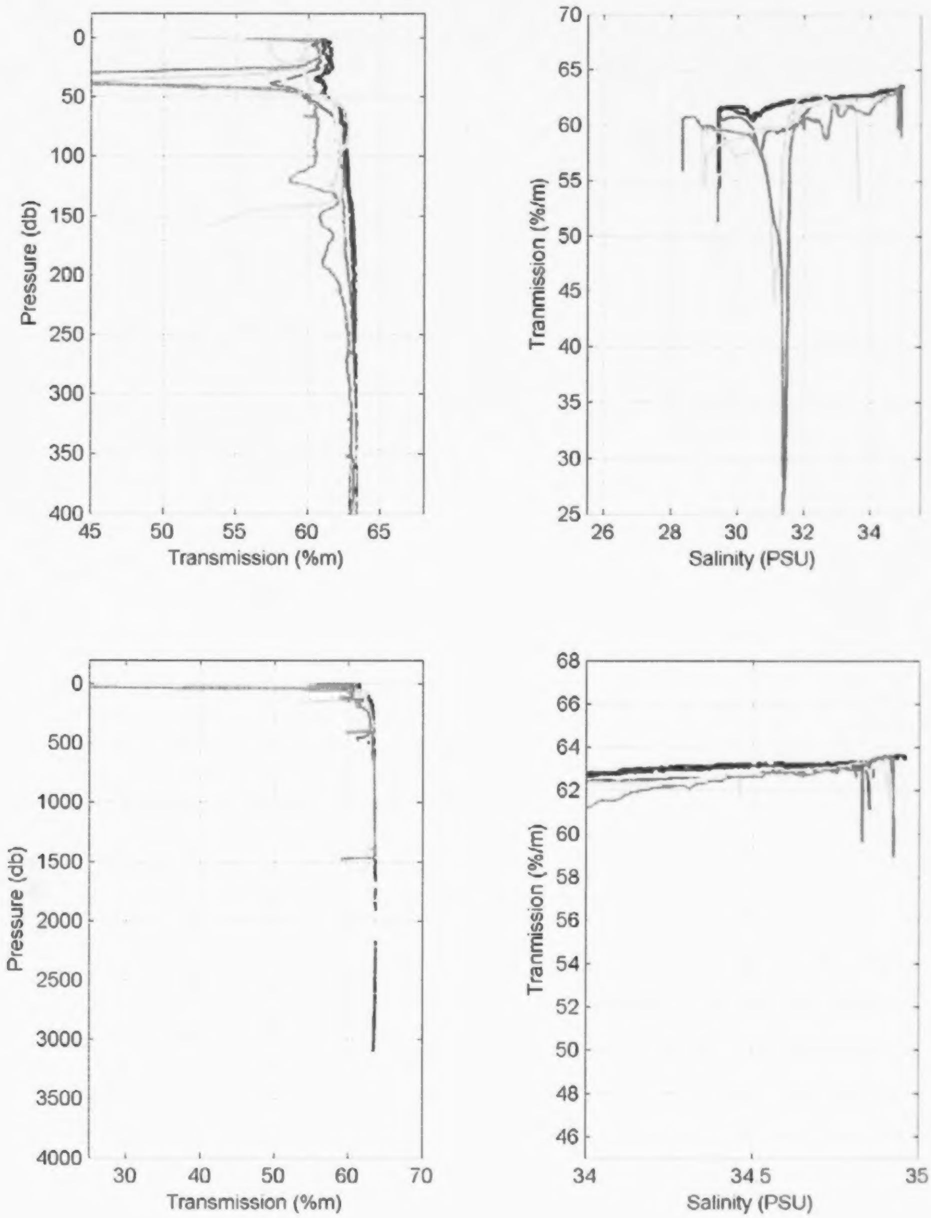
2003-21 Chukchi Cap (West of 160°W), Property: Salinity



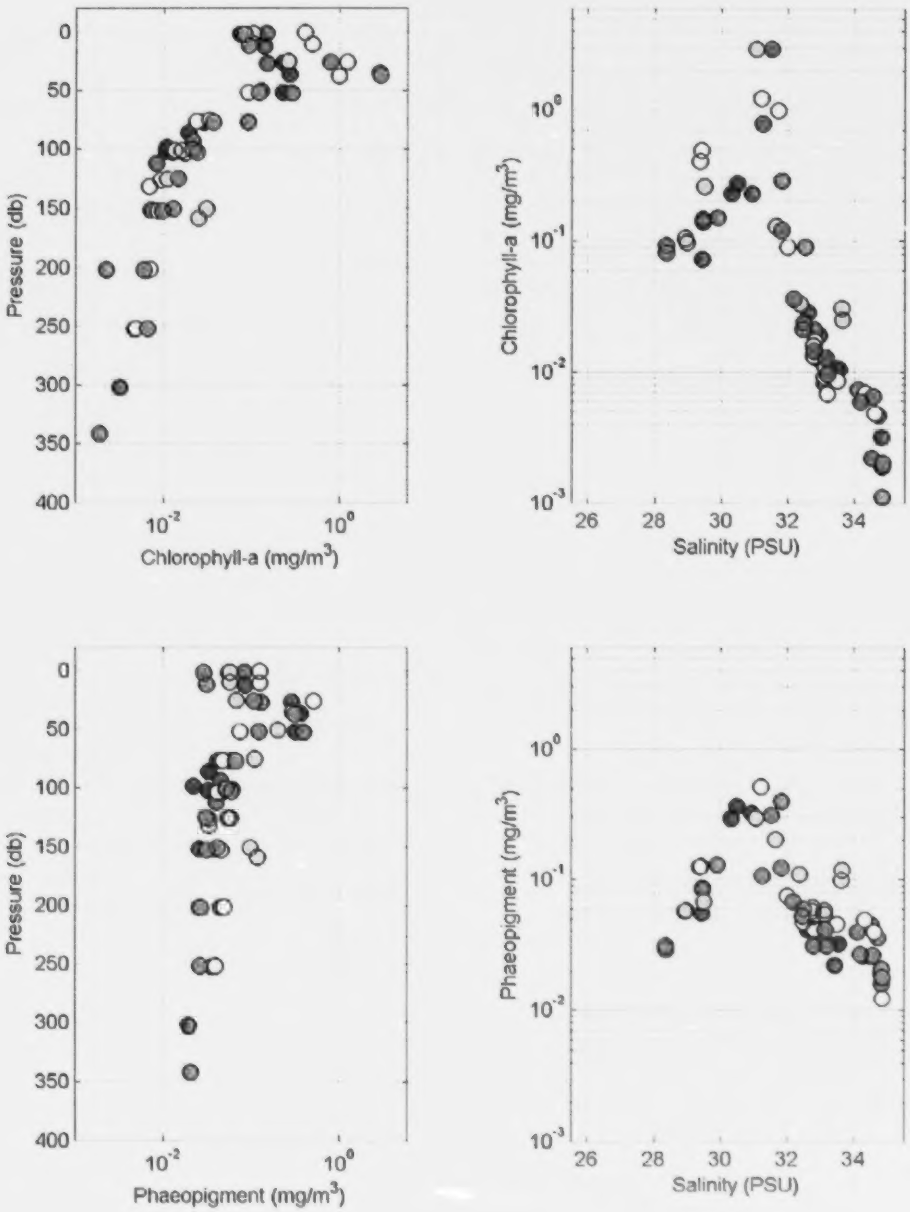
2003-21 Chukchi Cap (West of 160°W), Property: Oxygen



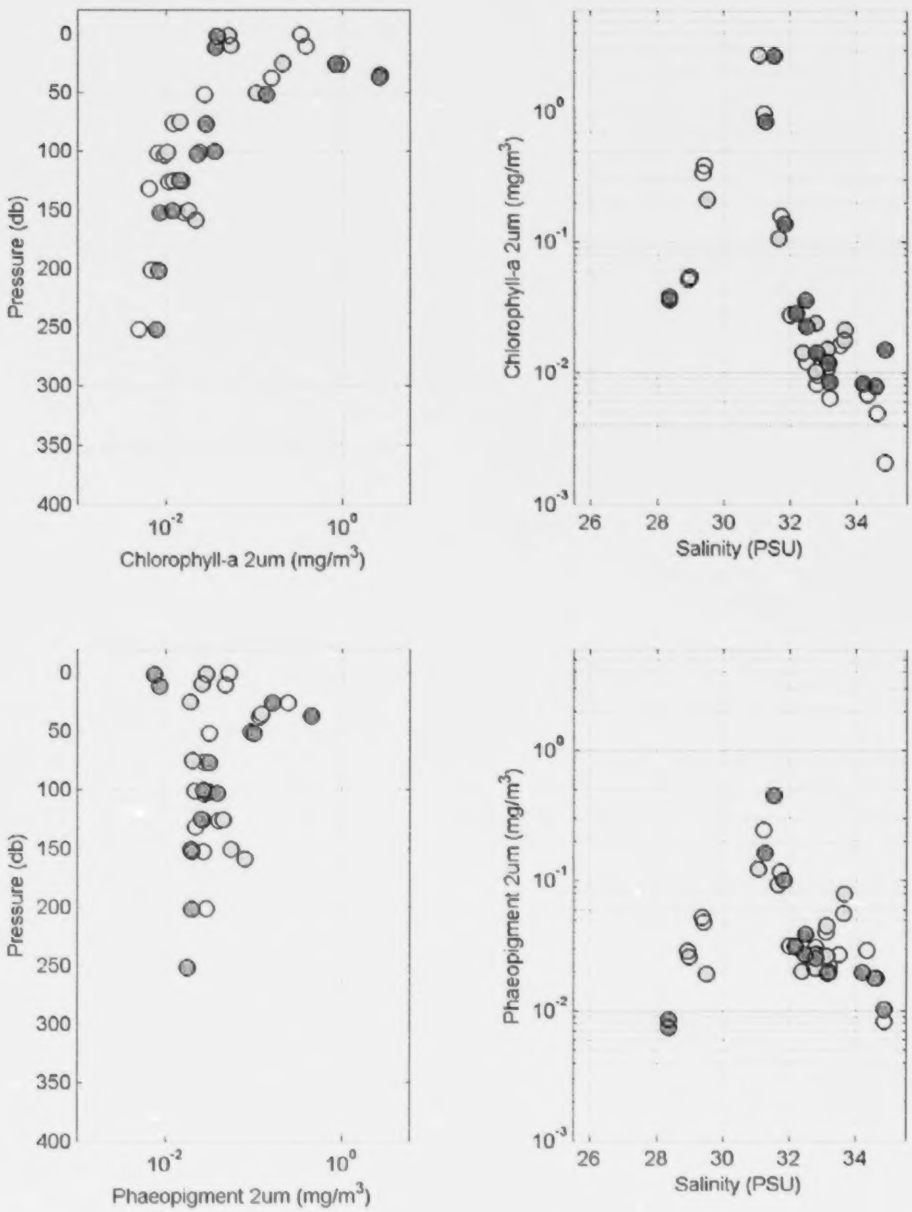
2003-21 Chukchi Cap (West of 160°W), Property: Transmission



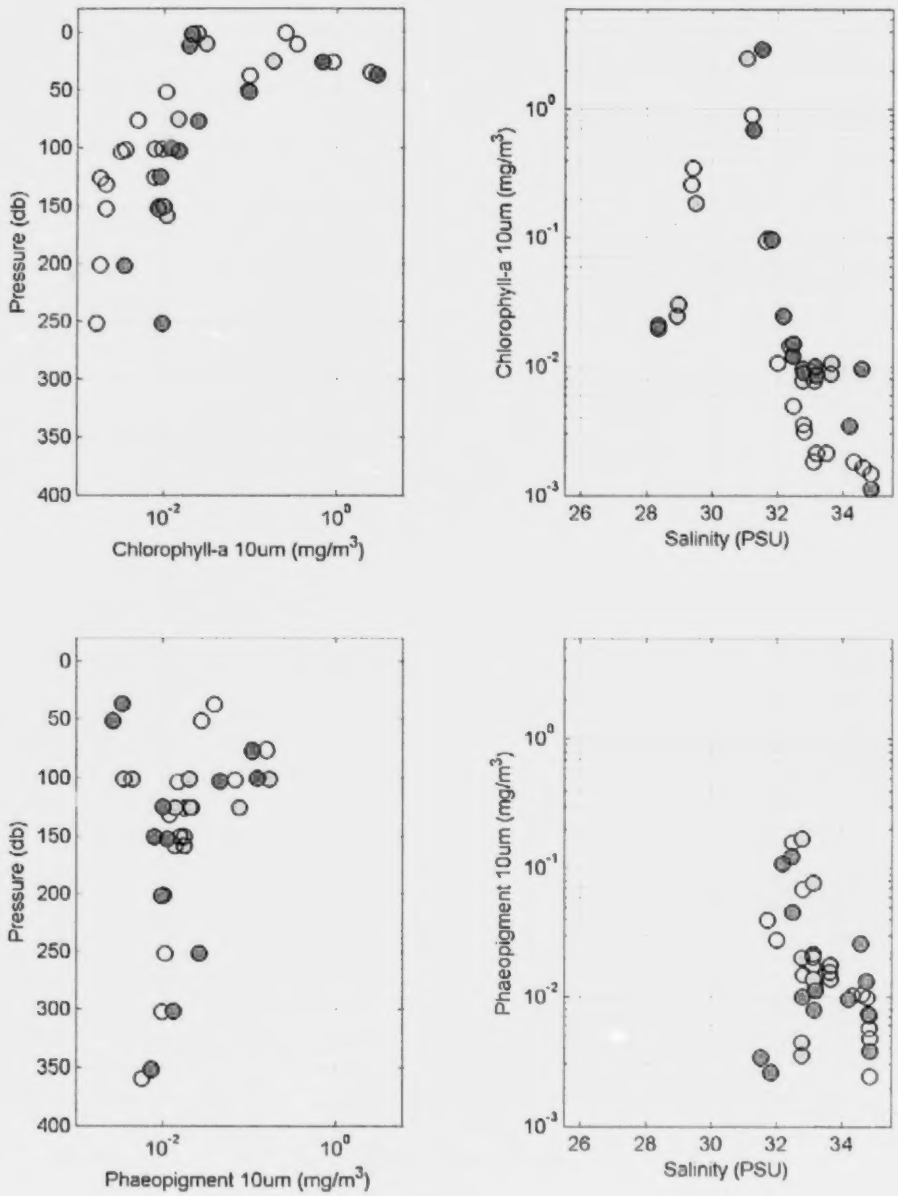
2003-21 Chukchi Cap (West of 160°W), Property: Chl-a, Phaeo



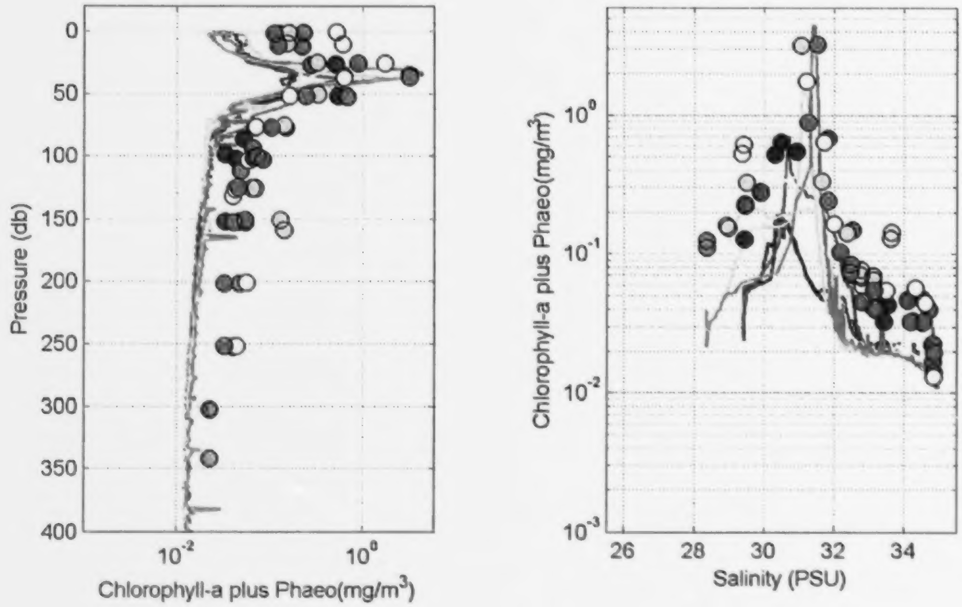
2003-21 Chukchi Cap (West of 160°W), Property: Chl-a, Phaeo, 2um Size Fractionation



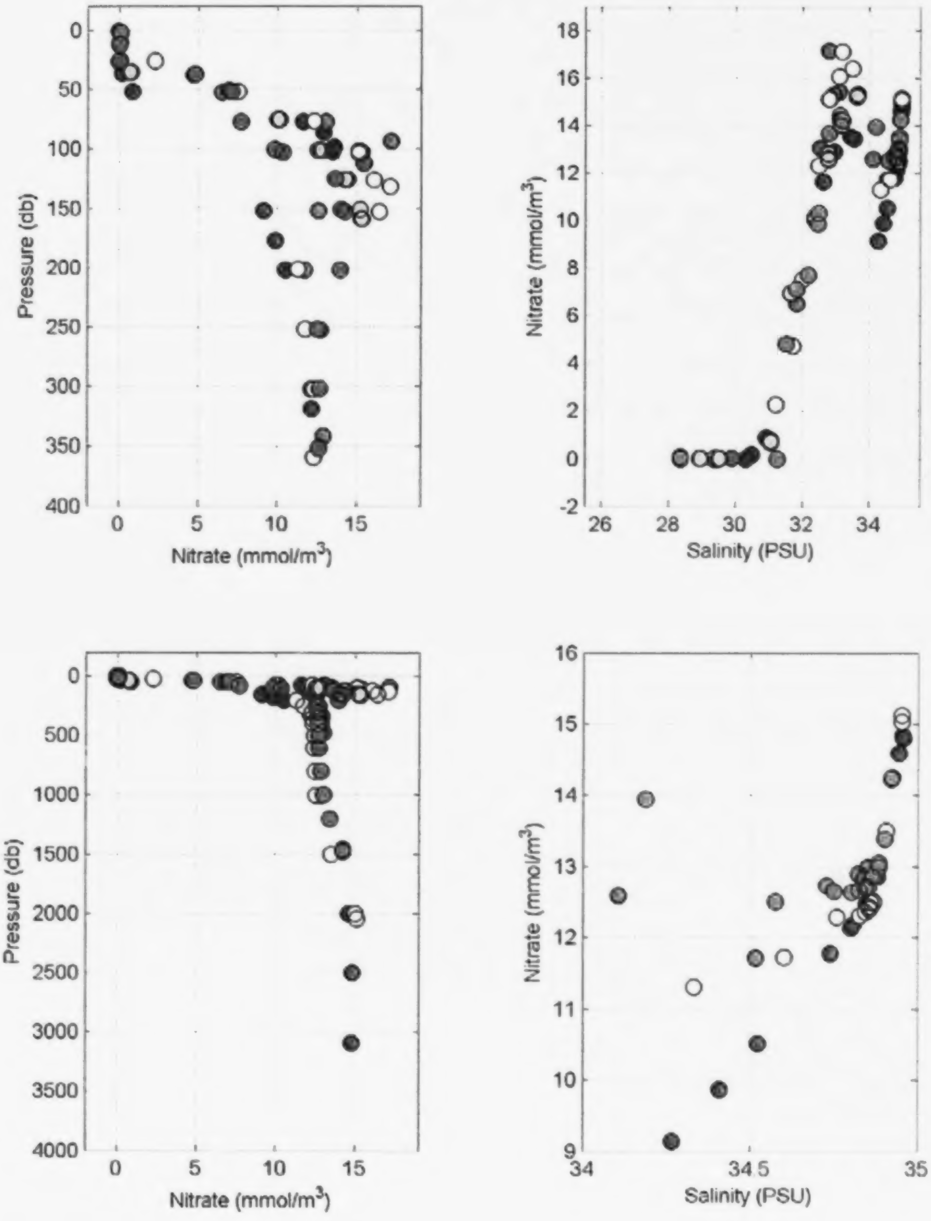
2003-21 Chukchi Cap (West of 160°W), Property: Chl-a, Phaeo, 10um Size Fractionation



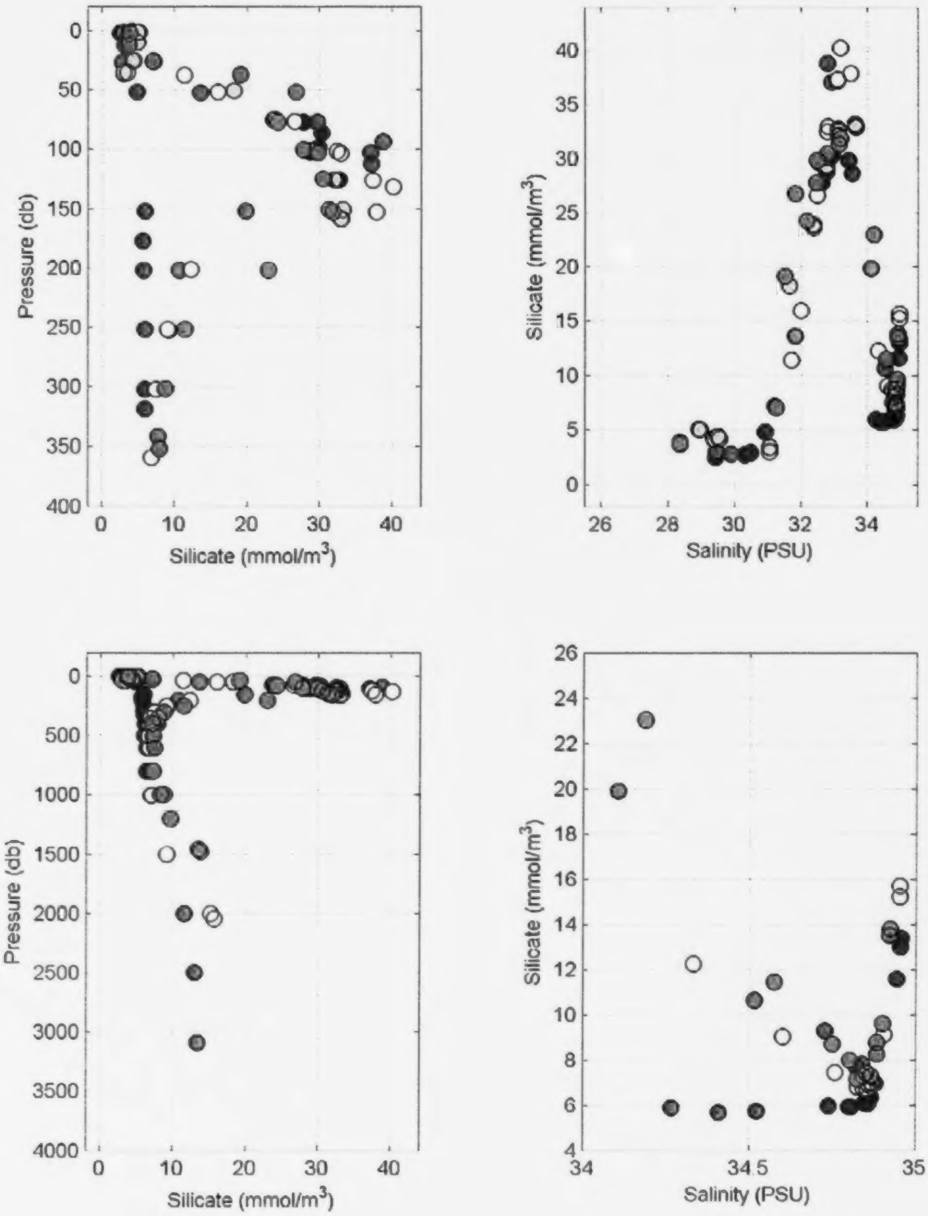
2003-21 Chukchi Cap (West of 160°W), Property: Combined Chl-a and Phaeo



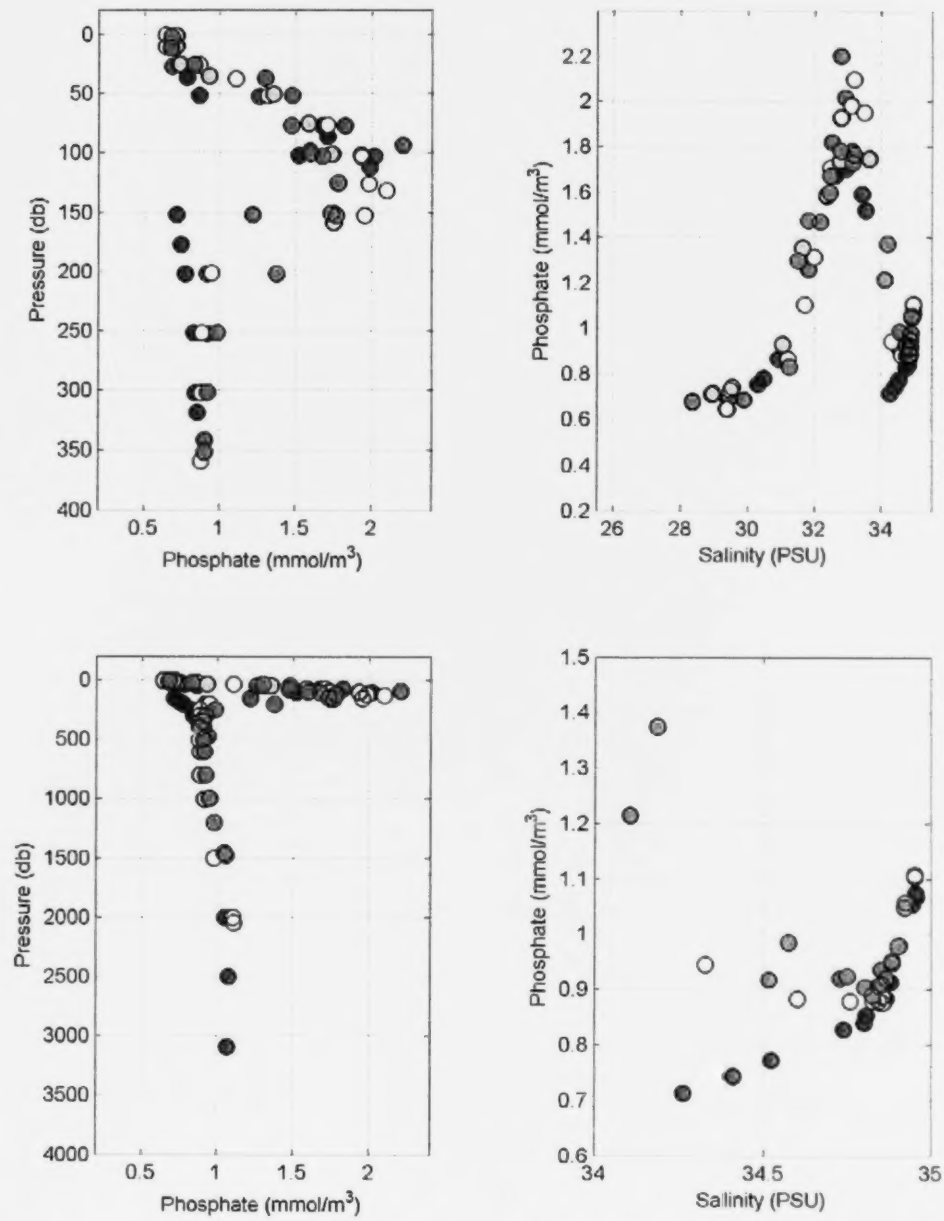
2003-21 Chukchi Cap (West of 160°W), Property: Nitrate and Nitrite



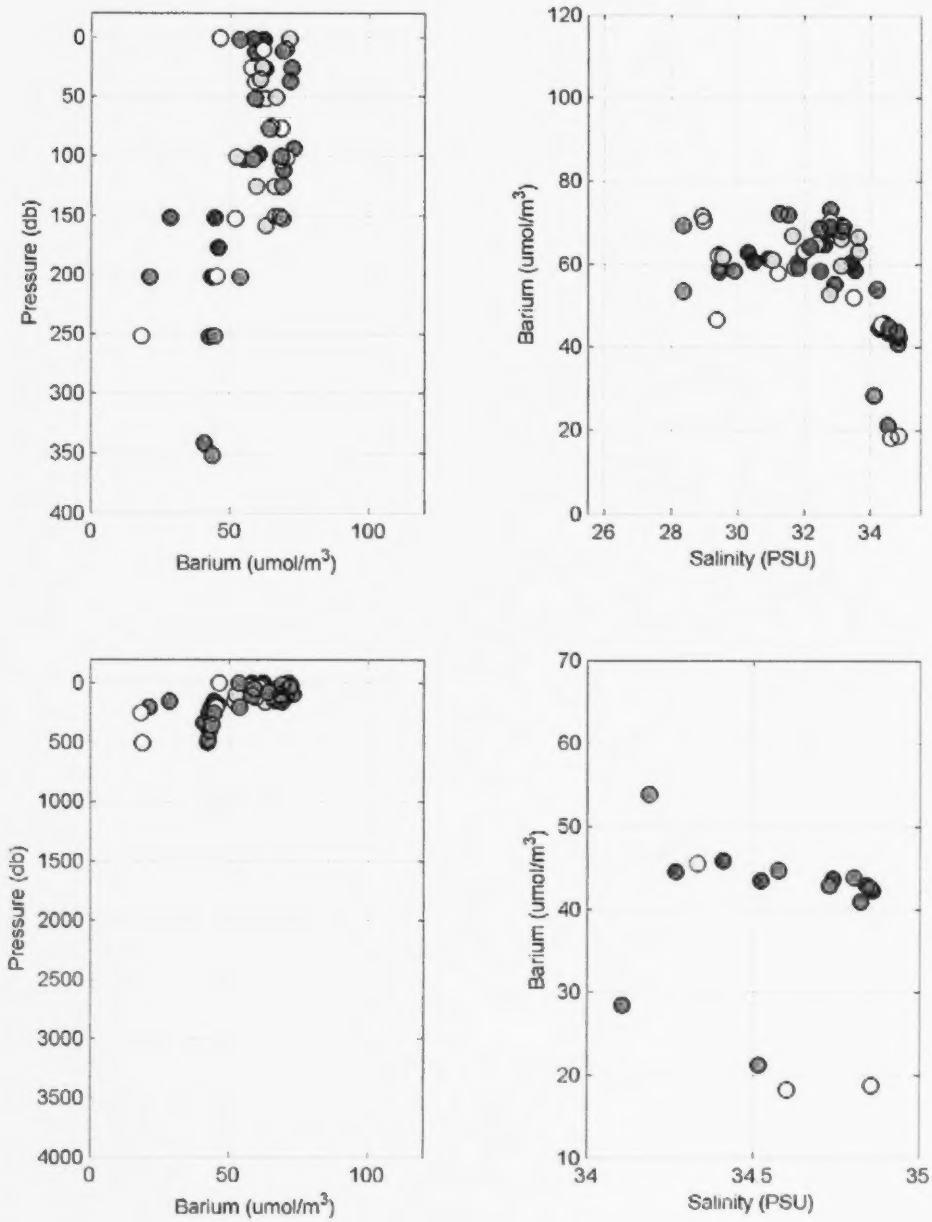
2003-21 Chukchi Cap (West of 160°W), Property: Silicate



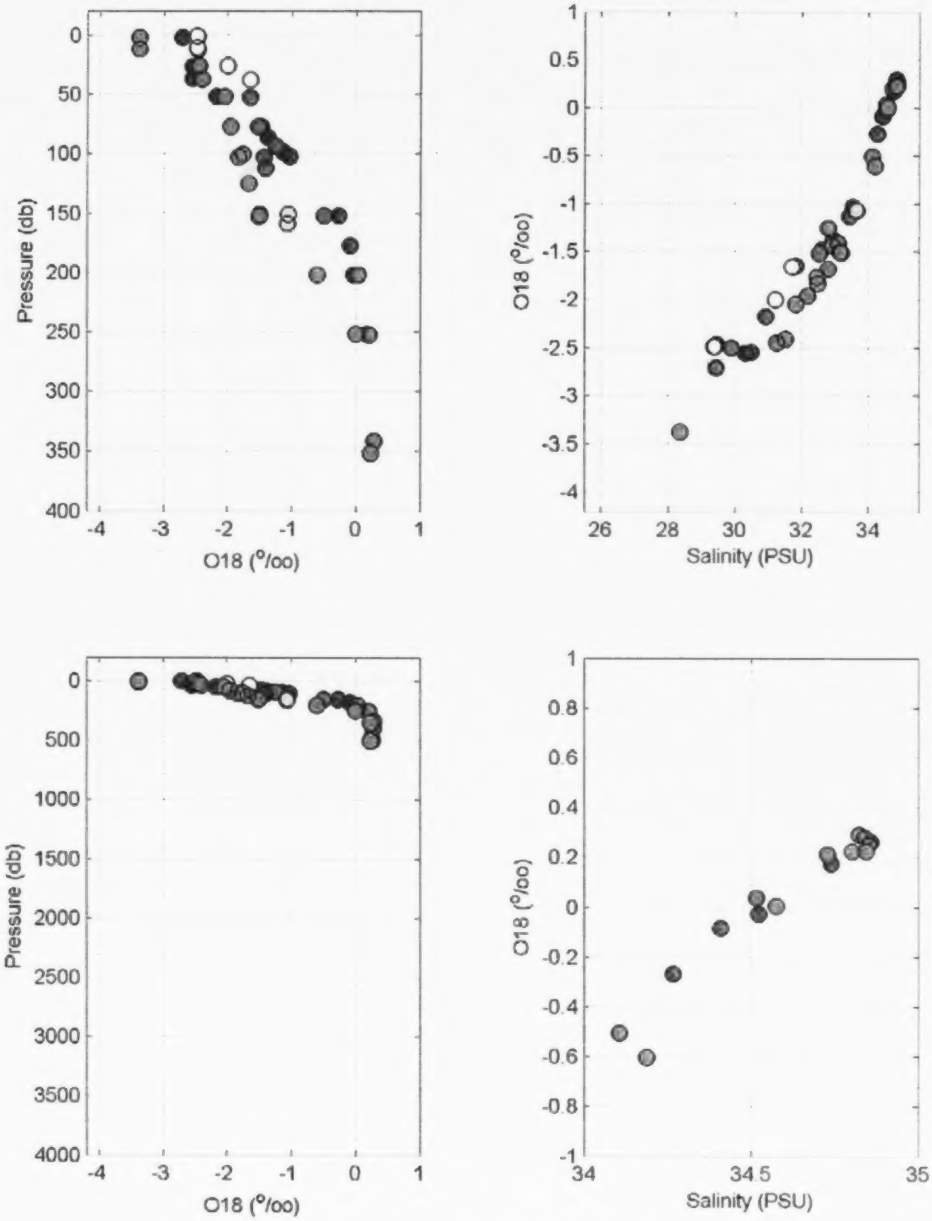
2003-21 Chukchi Cap (West of 160°W), Property: Phosphate



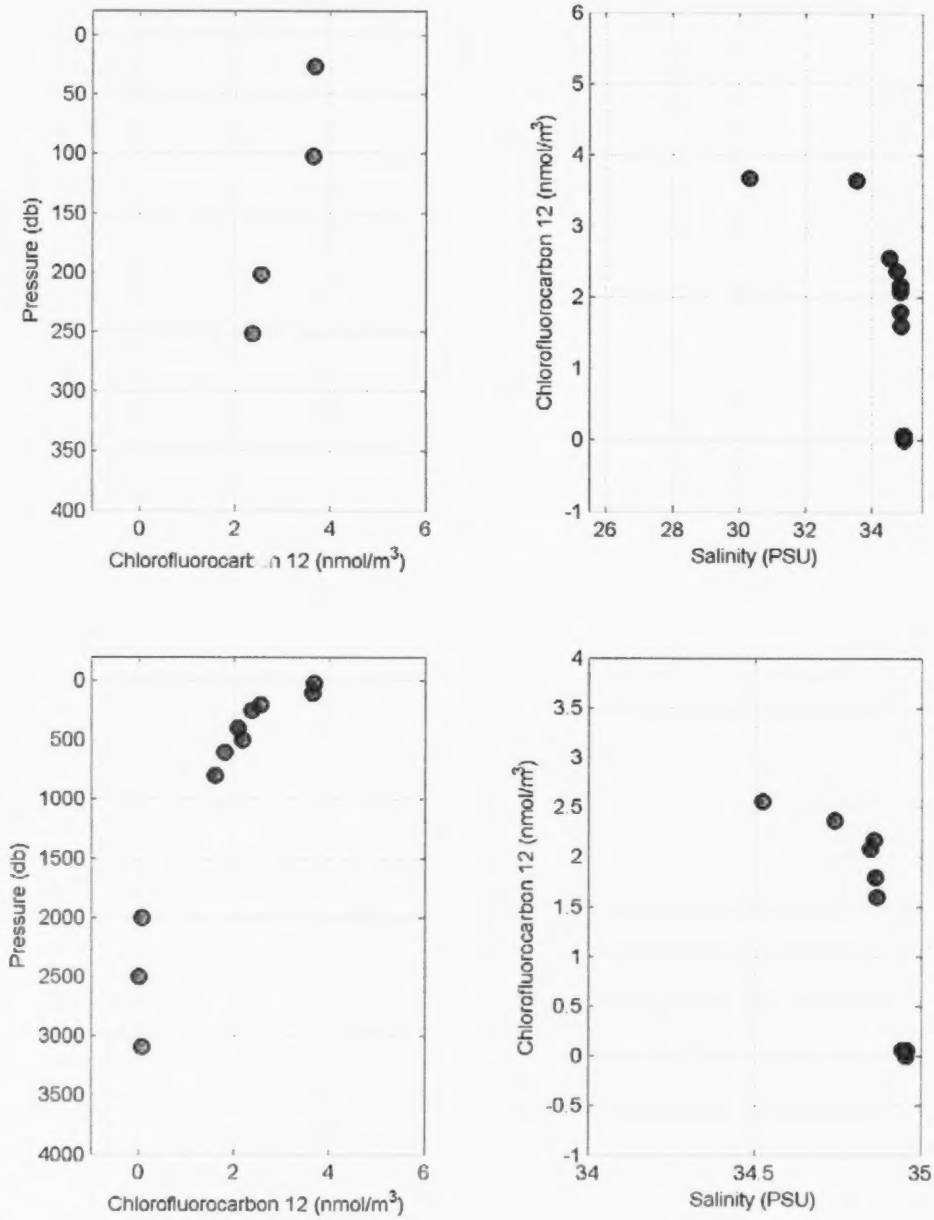
2003-21 Chukchi Cap (West of 160°W), Property: Barium



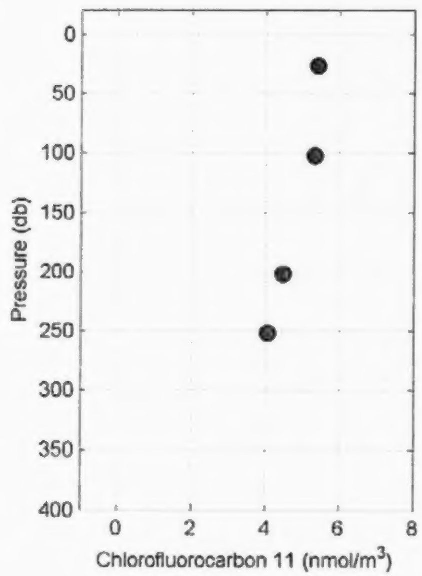
2003-21 Chukchi Cap (West of 160°W), Property: O18

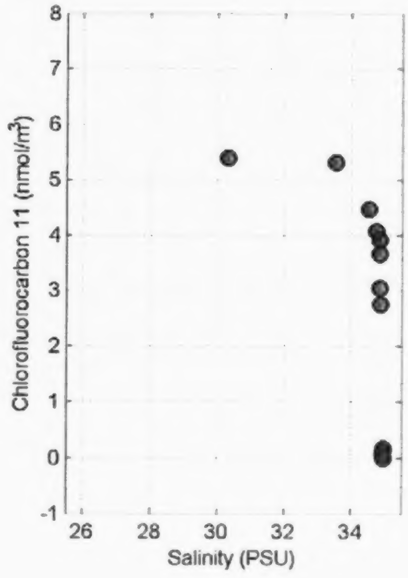


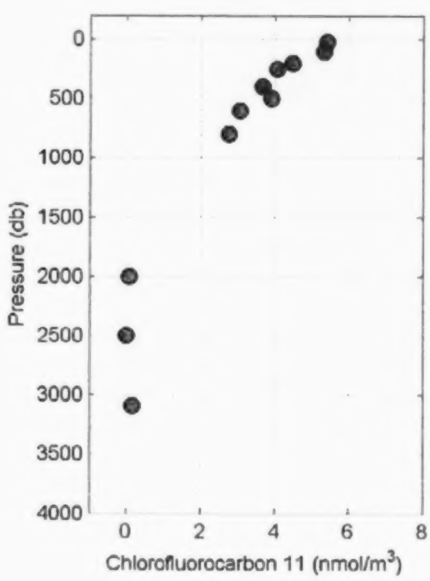
2003-21 Chukchi Cap (West of 160°W), Property: Chlorofluorcarbon-12

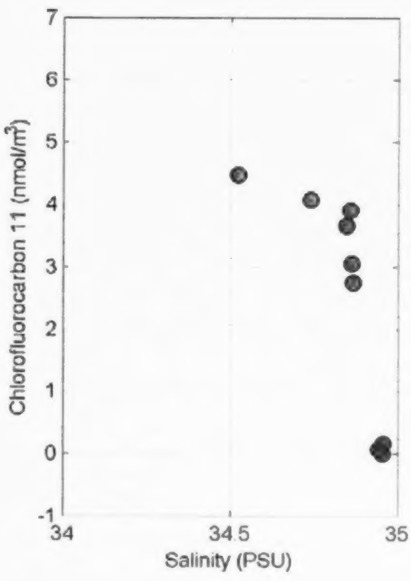


2003-21 Chukchi Cap (West of 160°W), Property: Chlorofluorcarbon-11

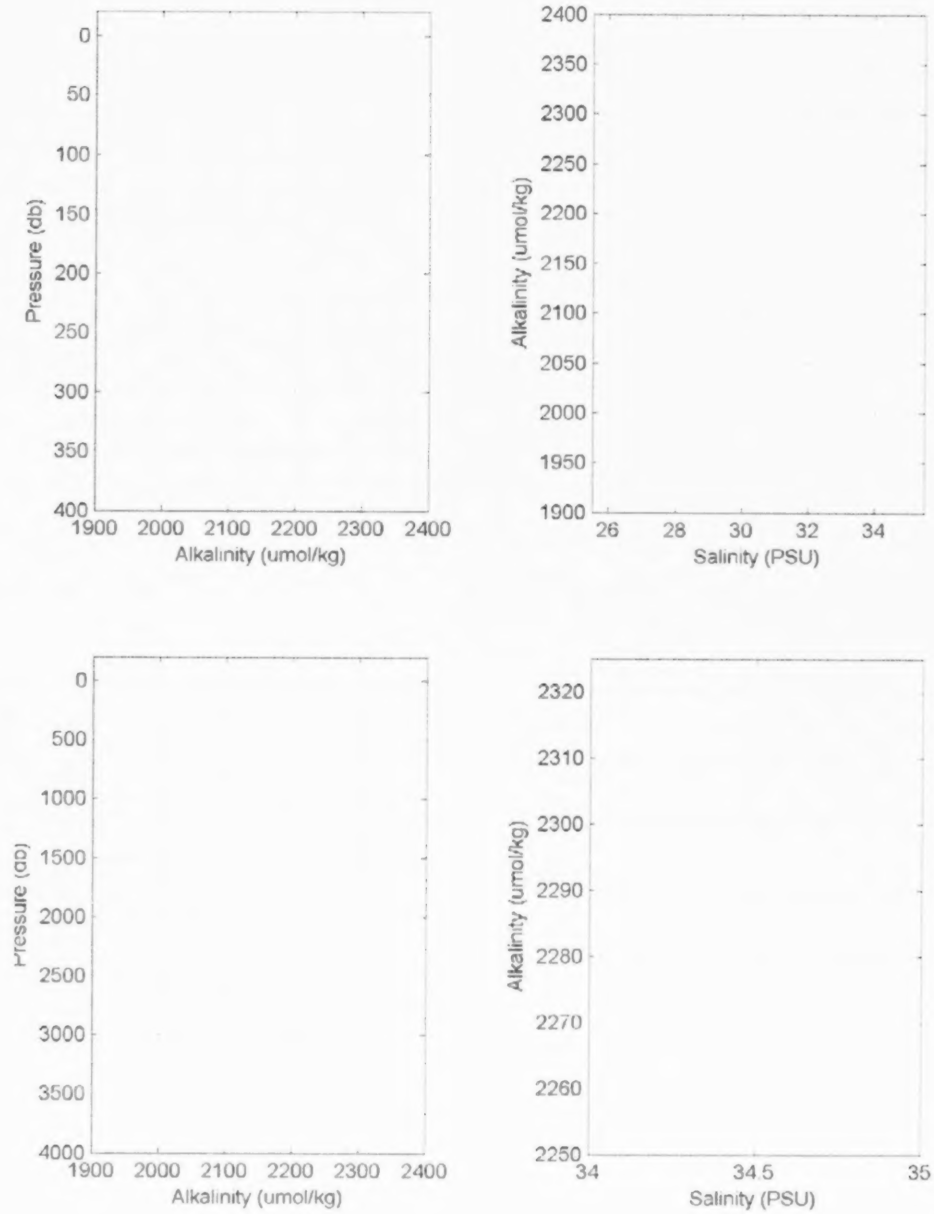




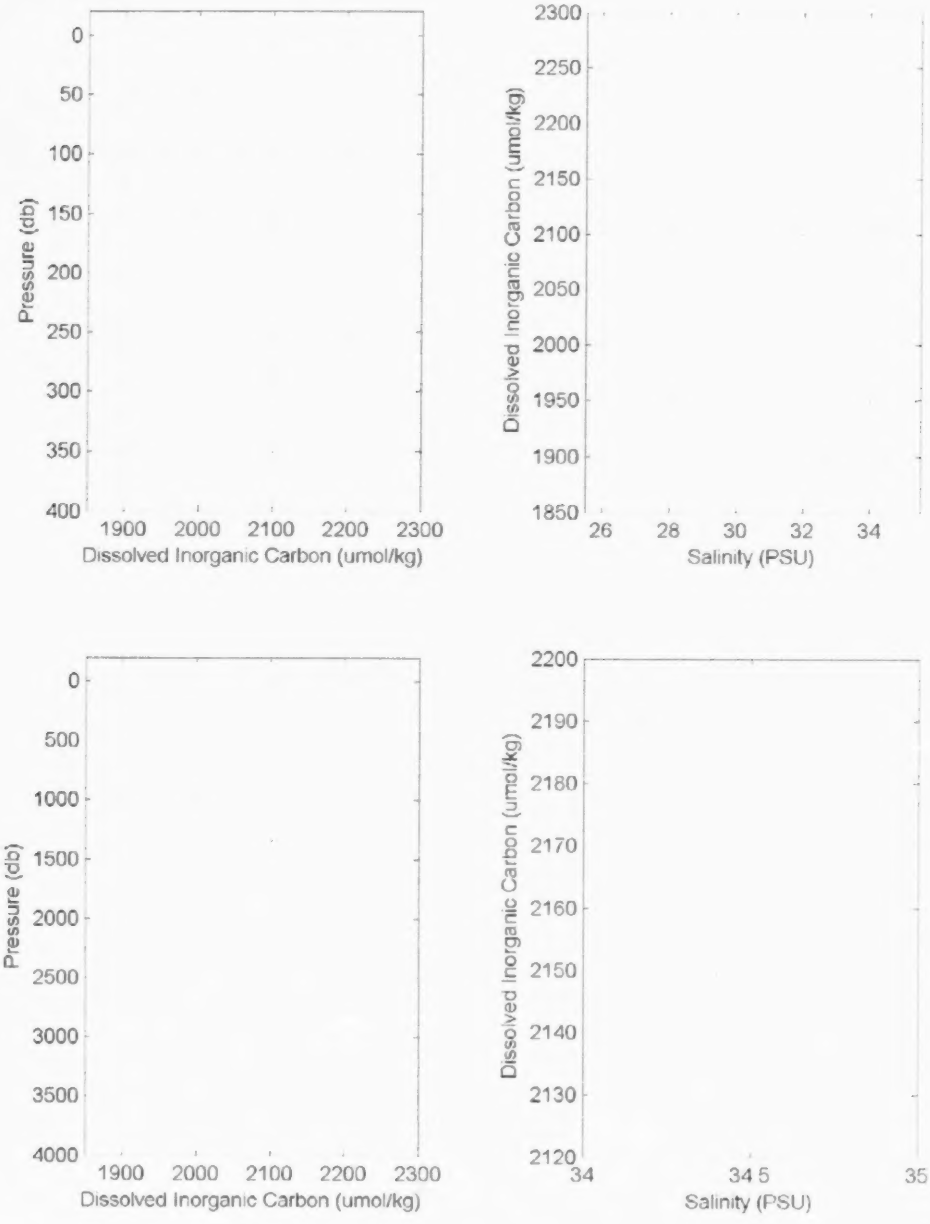




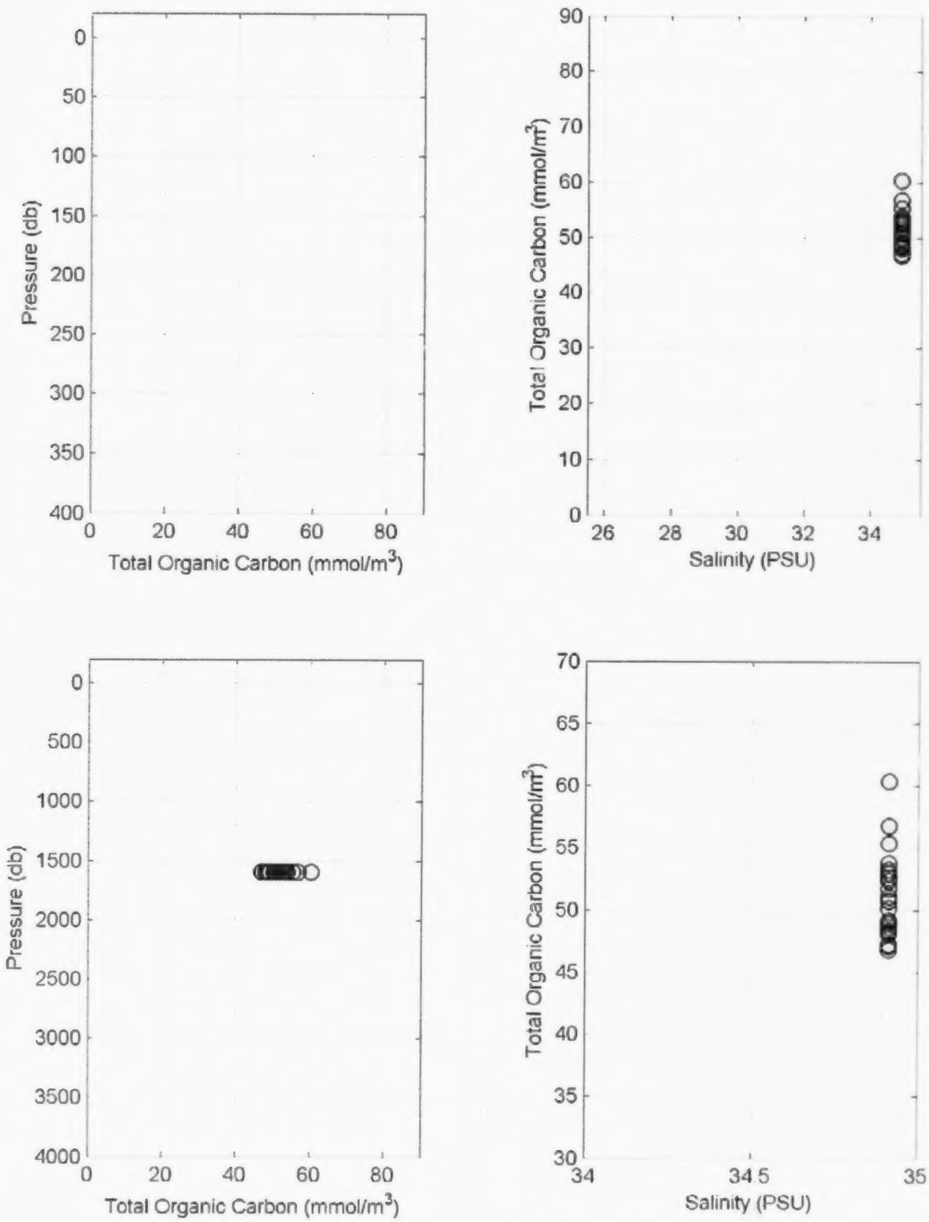
2003-21 Chukchi Cap (West of 160°W), Property: Alkalinity



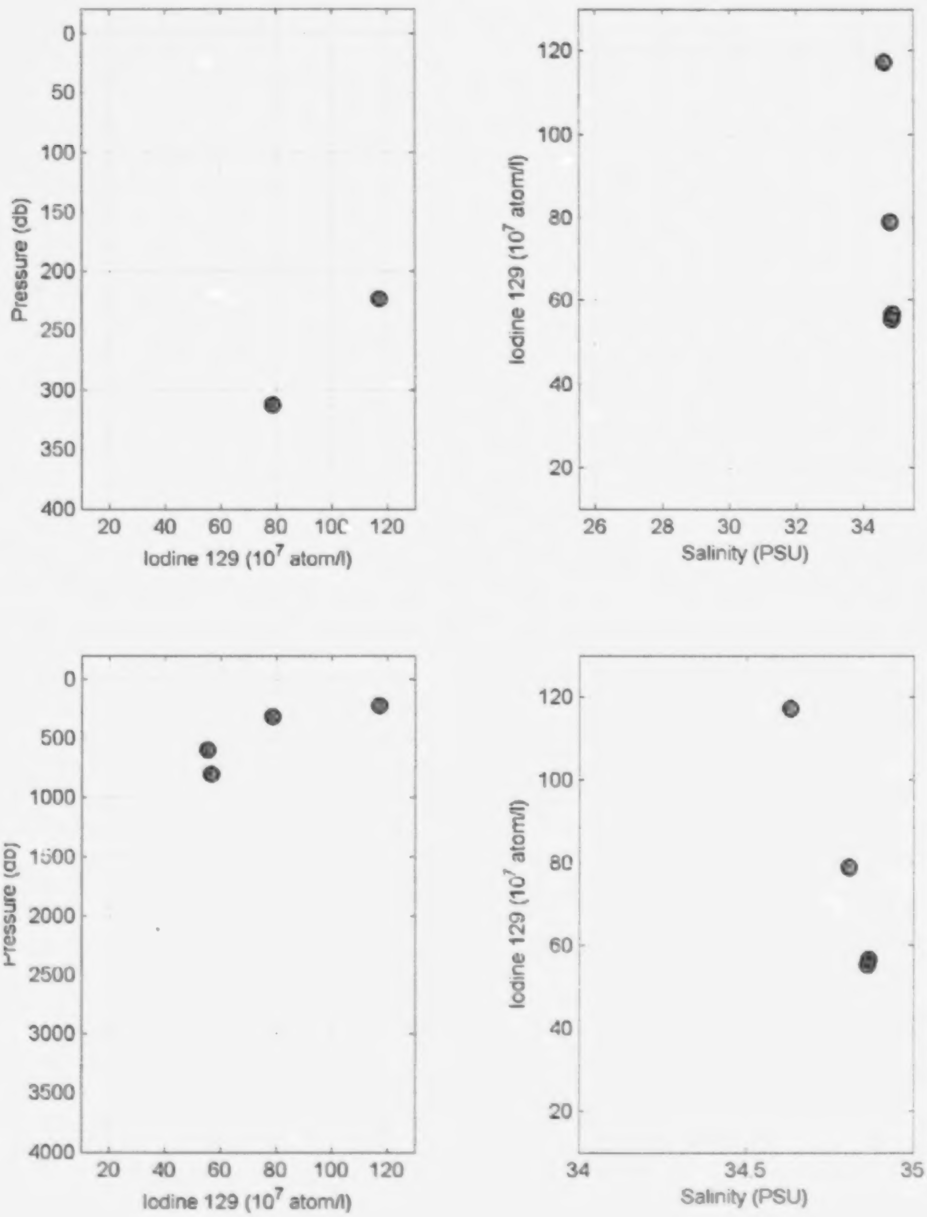
2003-21 Chukchi Cap (West of 160°W), Property: Dissolved Inorganic Carbon



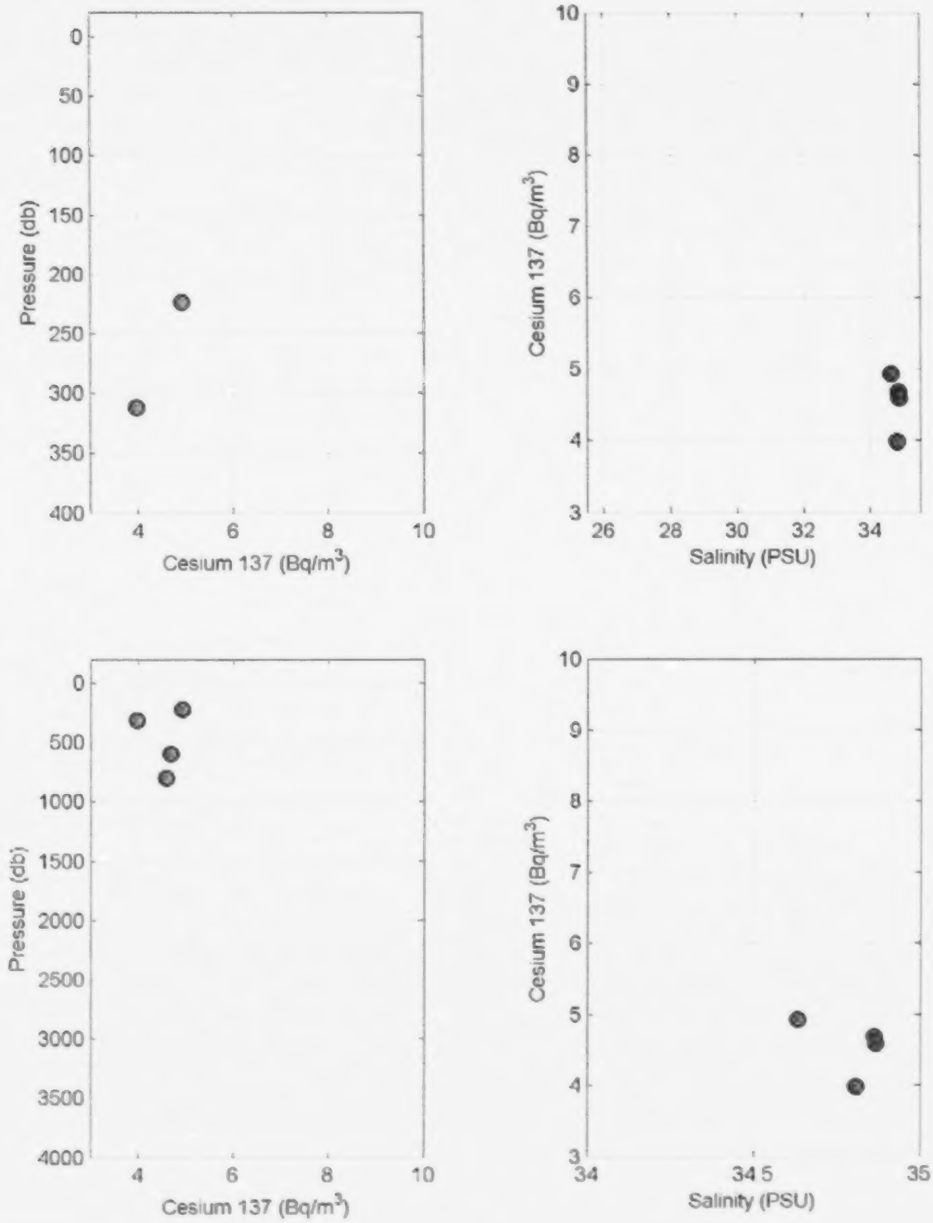
2003-21 Chukchi Cap (West of 160°W), Property: Total Organic Carbon



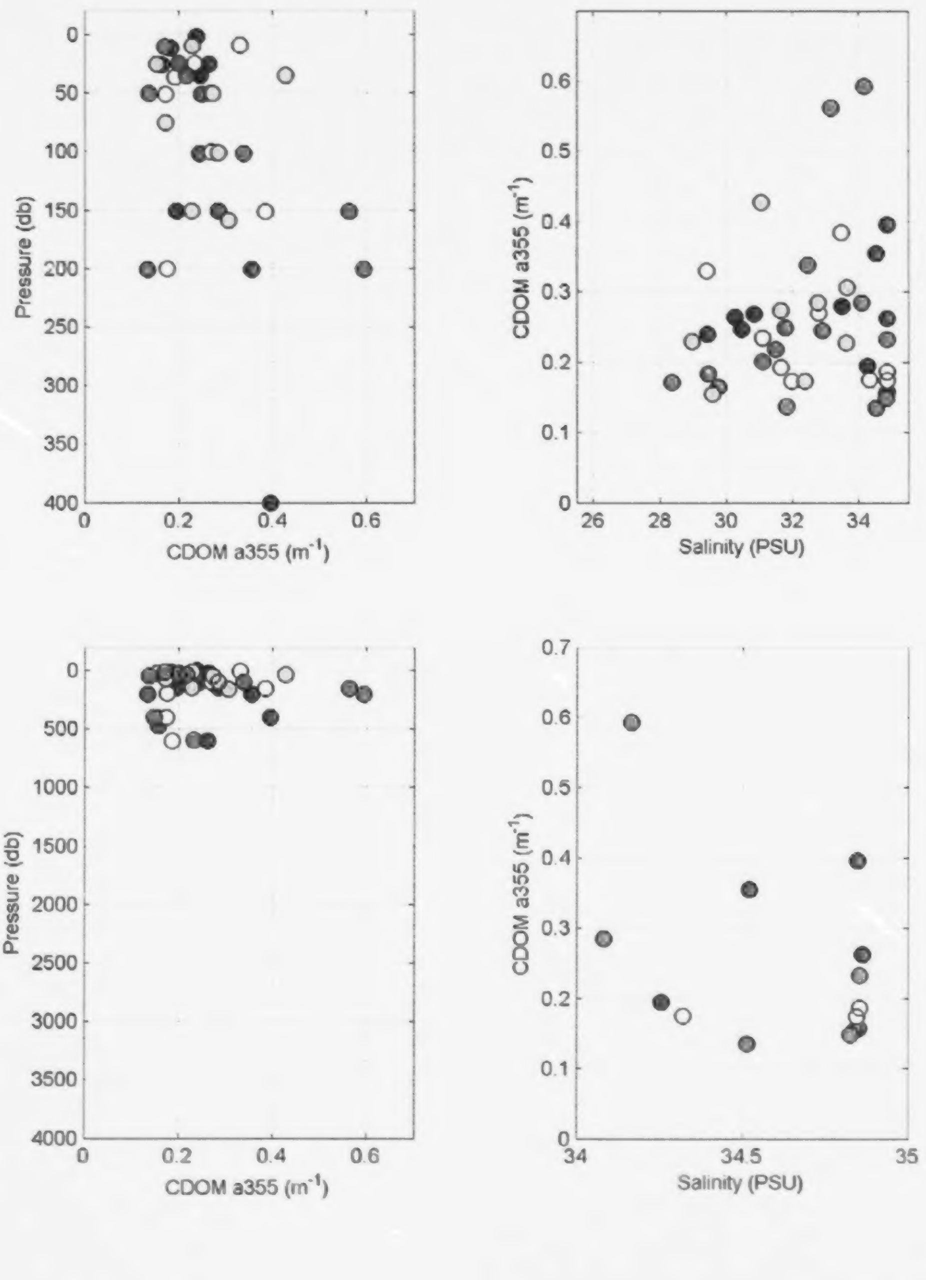
2003-21 Chukchi Cap (West of 160°W), Property: Iodine-129



2003-21 Chukchi Cap (West of 160°W), Property: Cesium-137



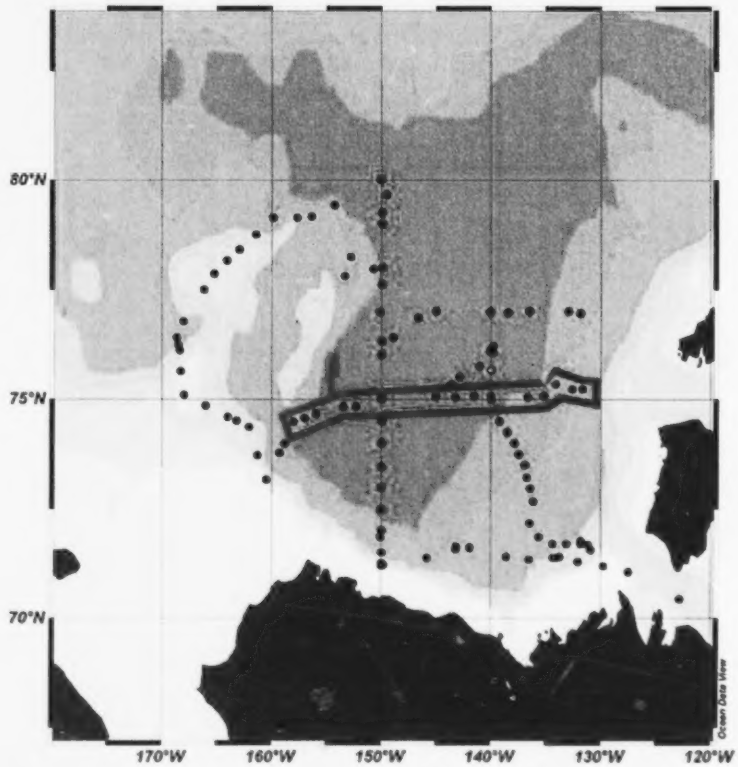
2003-21 Group: Casts along Chukchi Cap (West of ~160°W), Property: CDOM a355



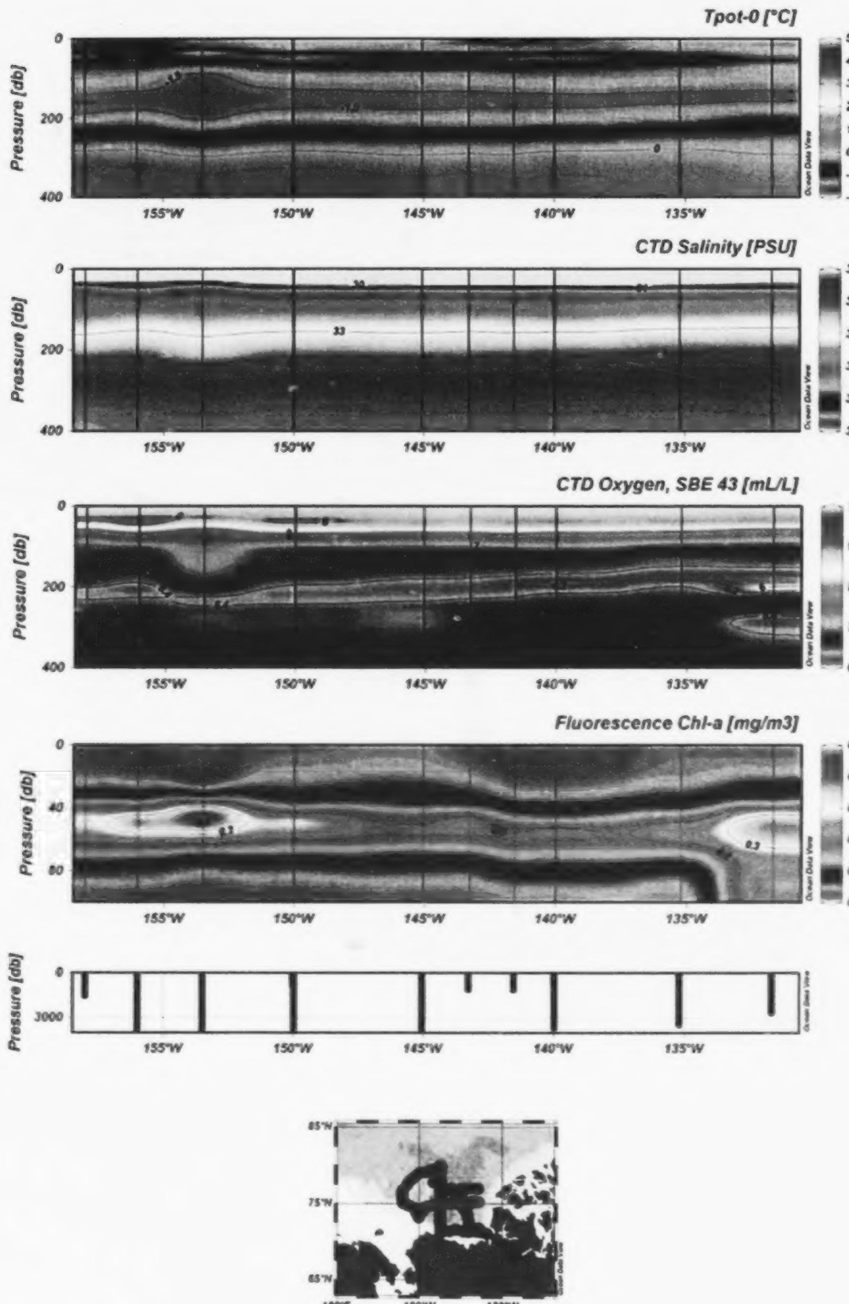
7. SECTION PLOTS

Section Plots of CTD and Chemistry data from 0 to 400 db and 0 to 1500 db. Note that within the set of CTD figures 0 to 400 db, the fluorescence axis is only 0 to 100 db.

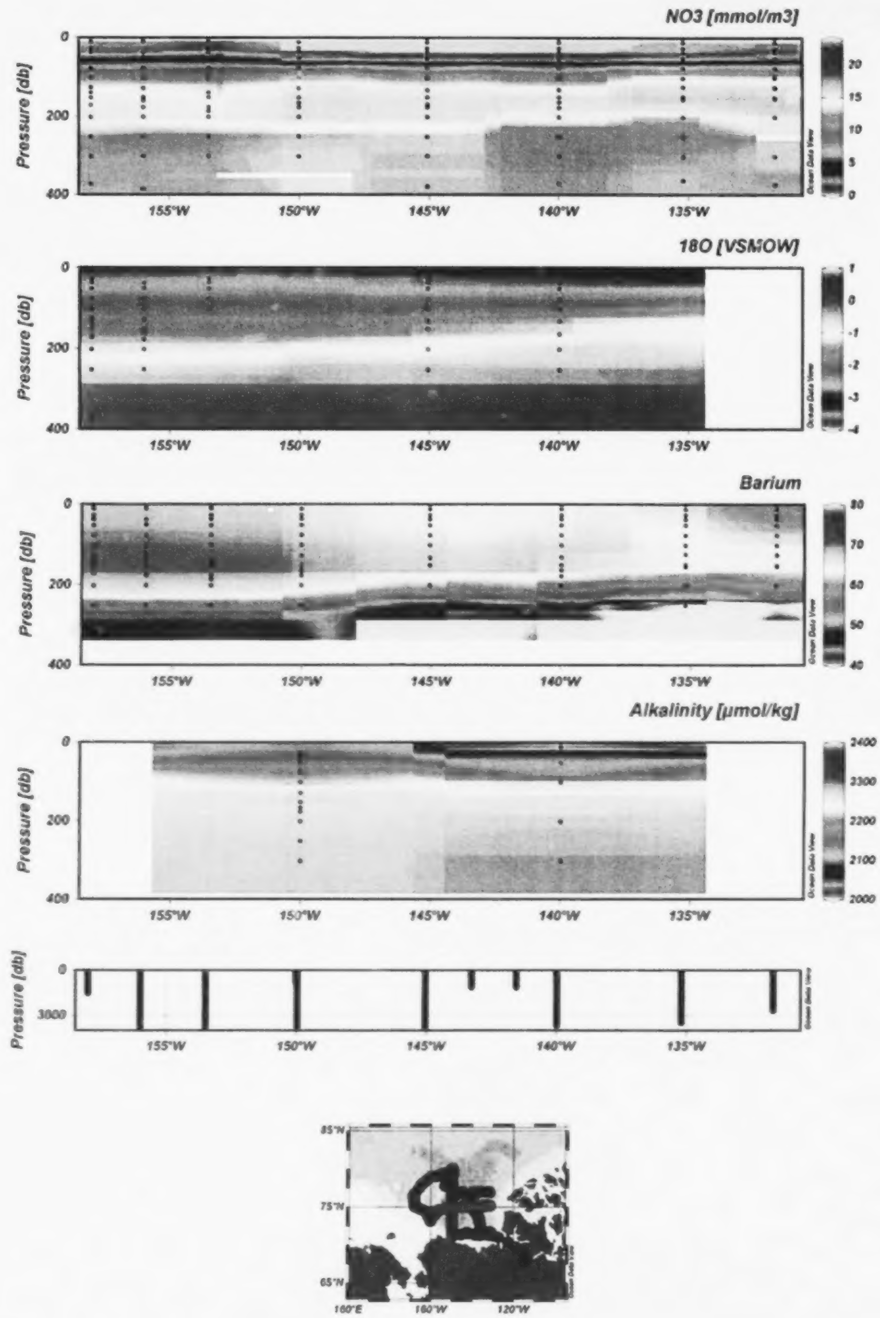
Map - 75°N Section



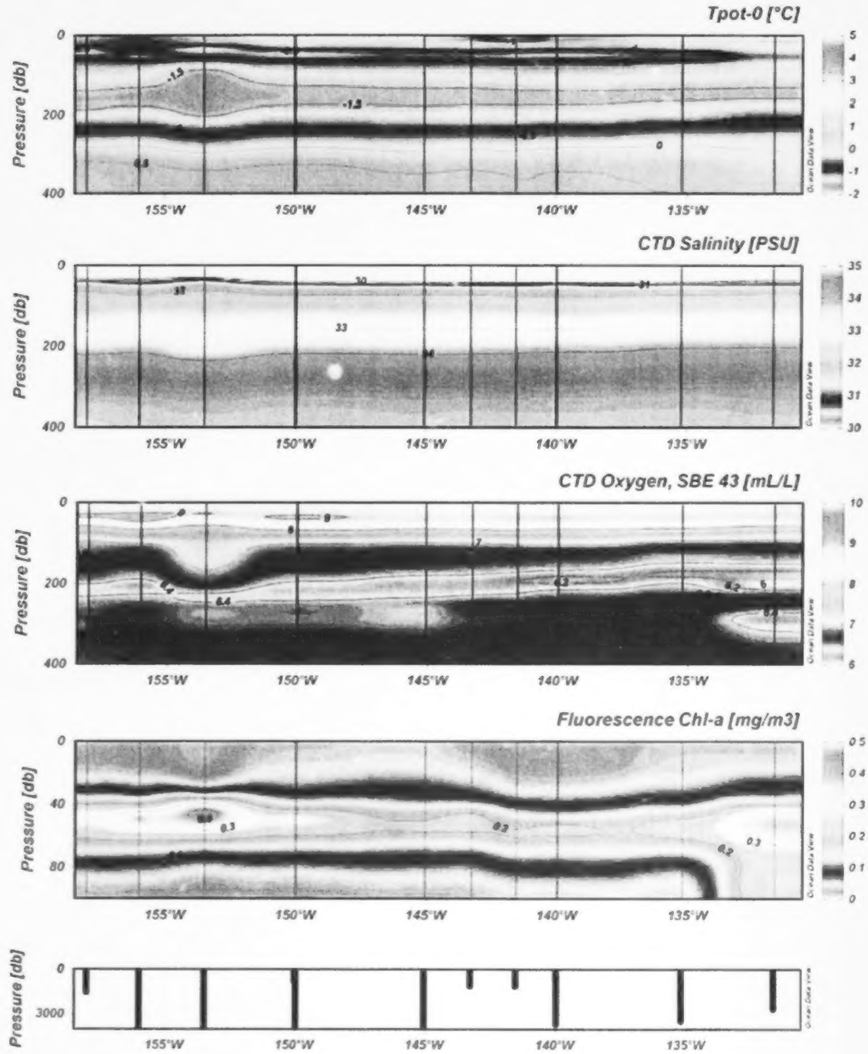
75°N Section, 0 to 400 db, CTD Data

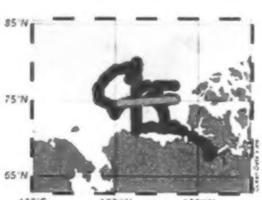


75°N Section, 0 to 400 db, Chemistry Data

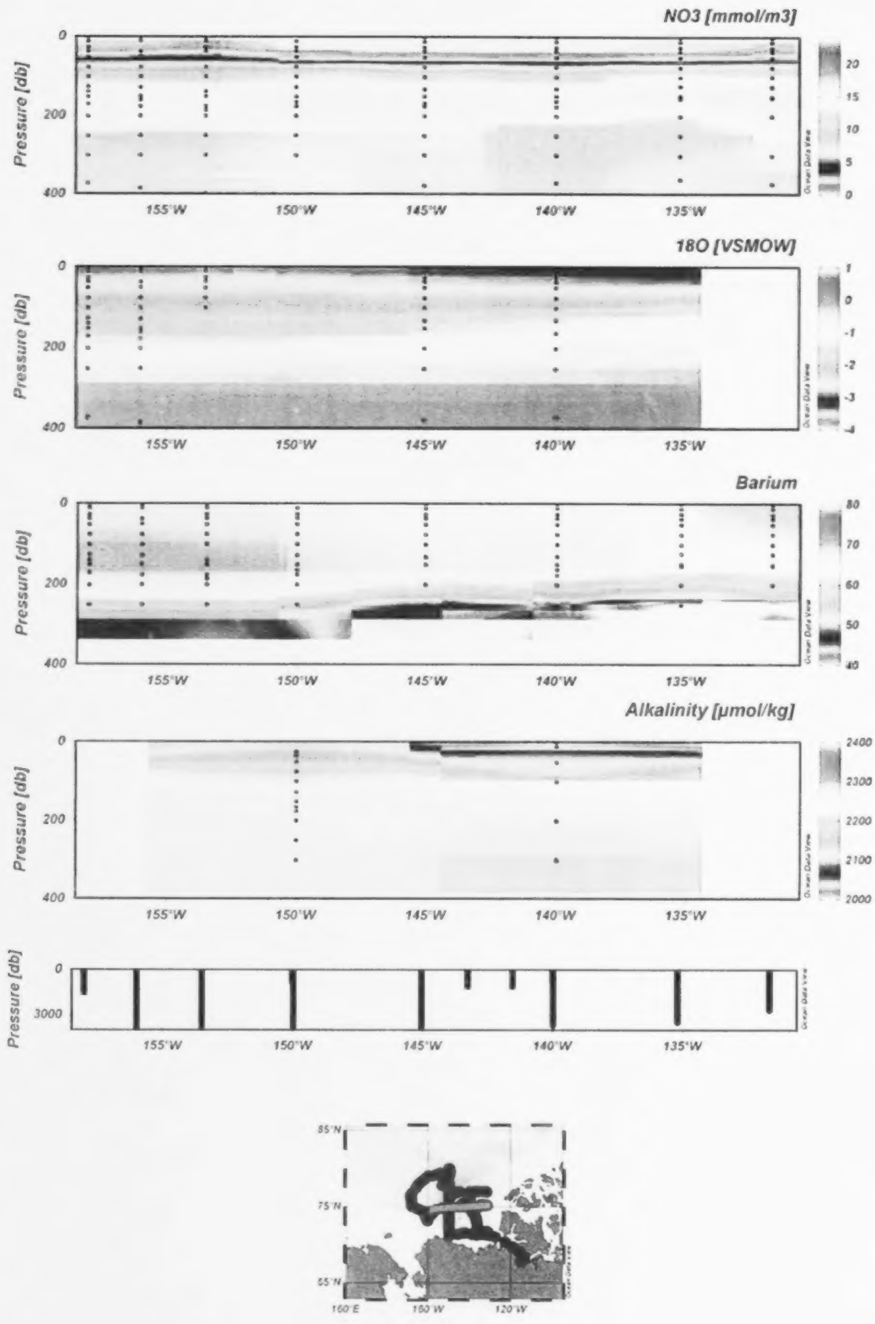


75°N Section, 0 to 400 db, CTD Data

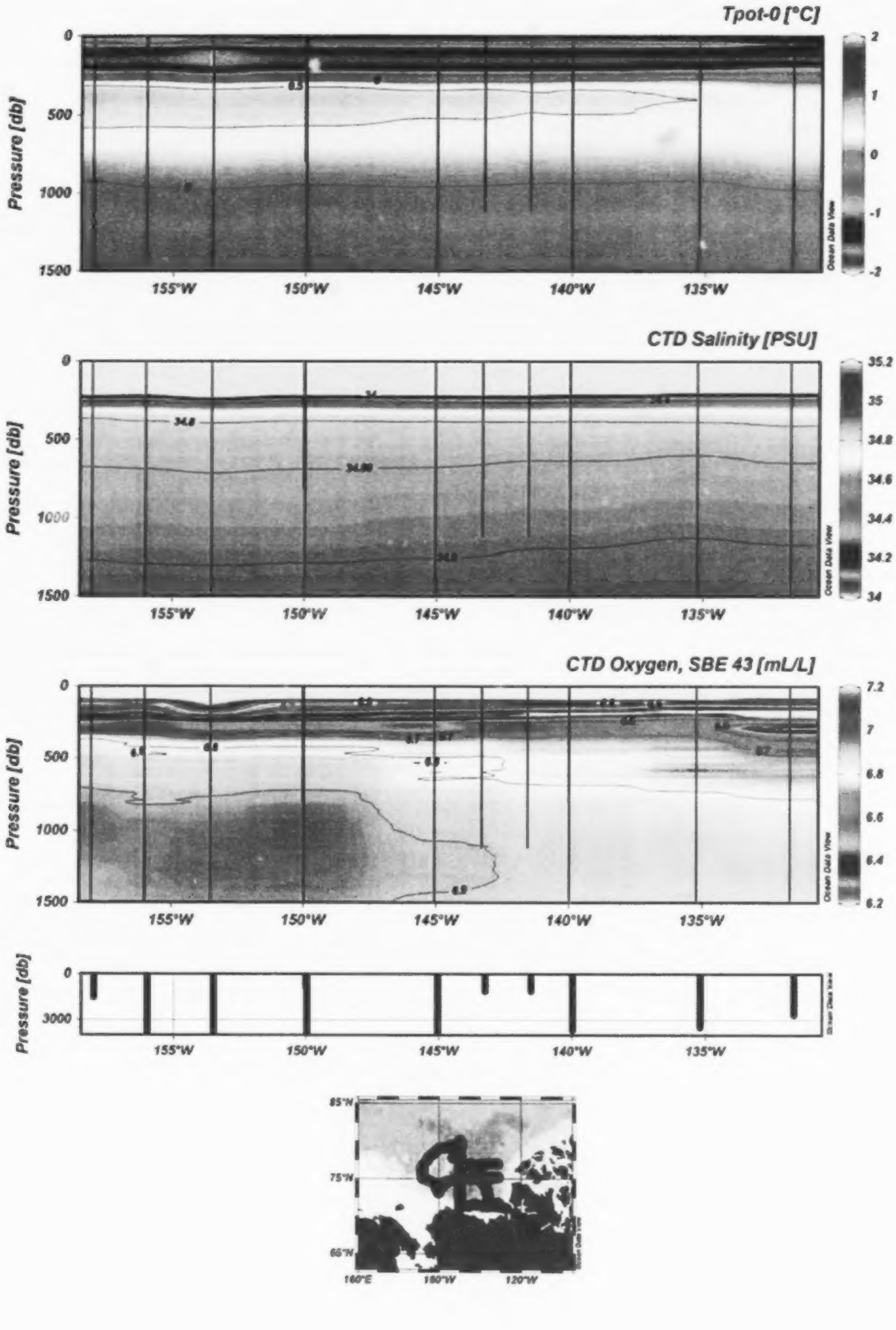




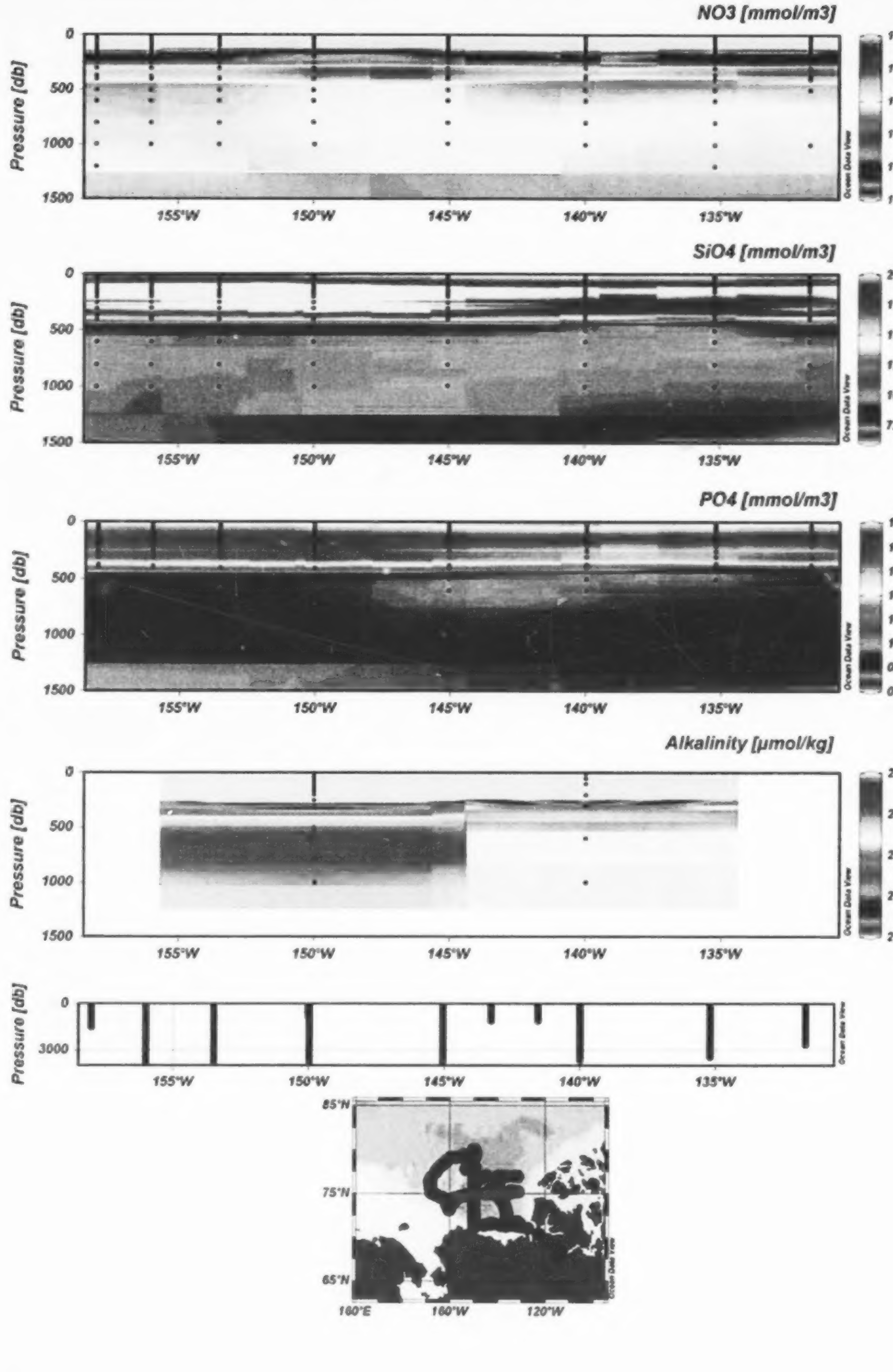
75°N Section, 0 to 400 db, Chemistry Data



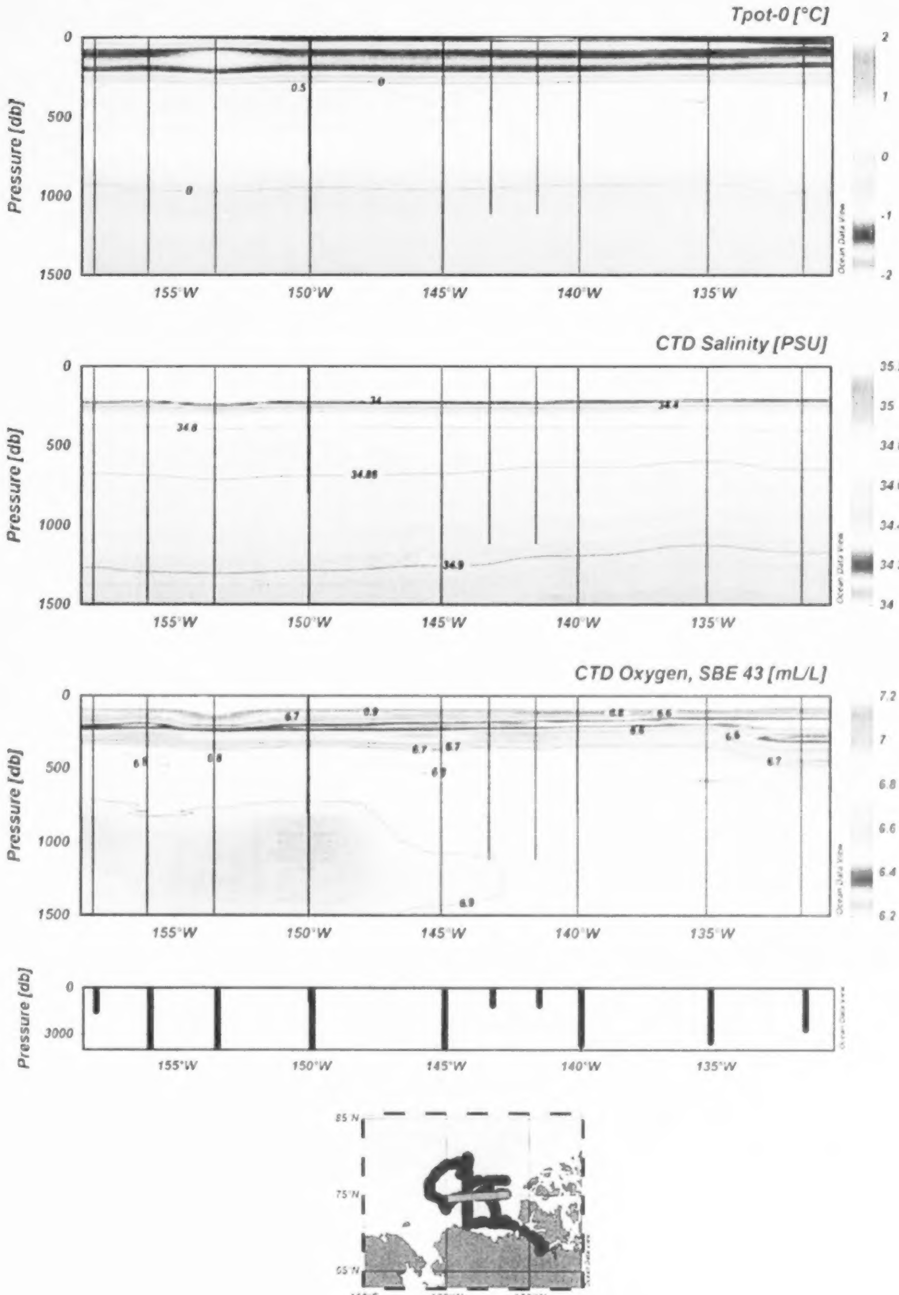
75°N Section, 0 to 1500 db, CTD Data



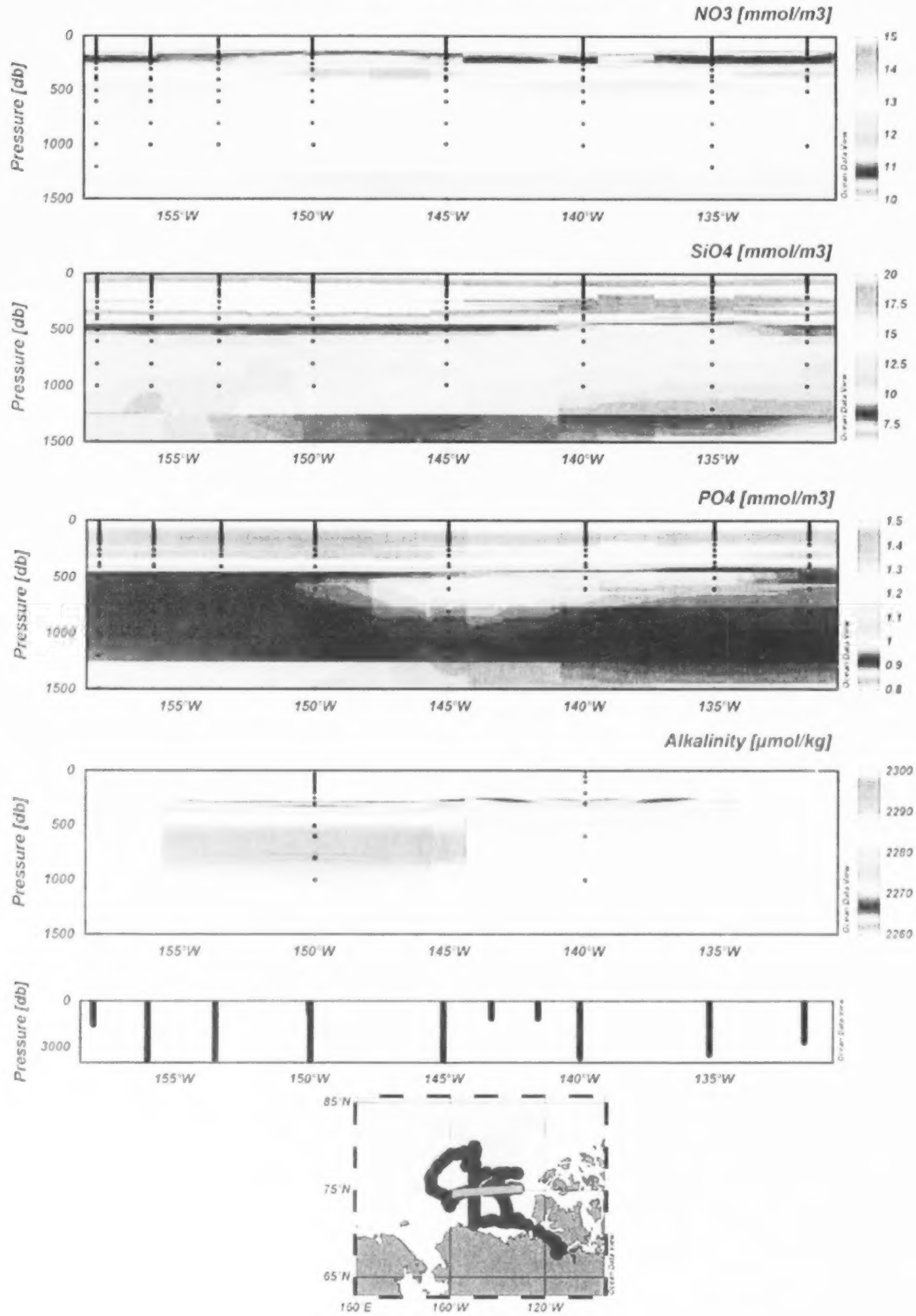
75°N Section, 0 to 1500 db, Chemistry Data



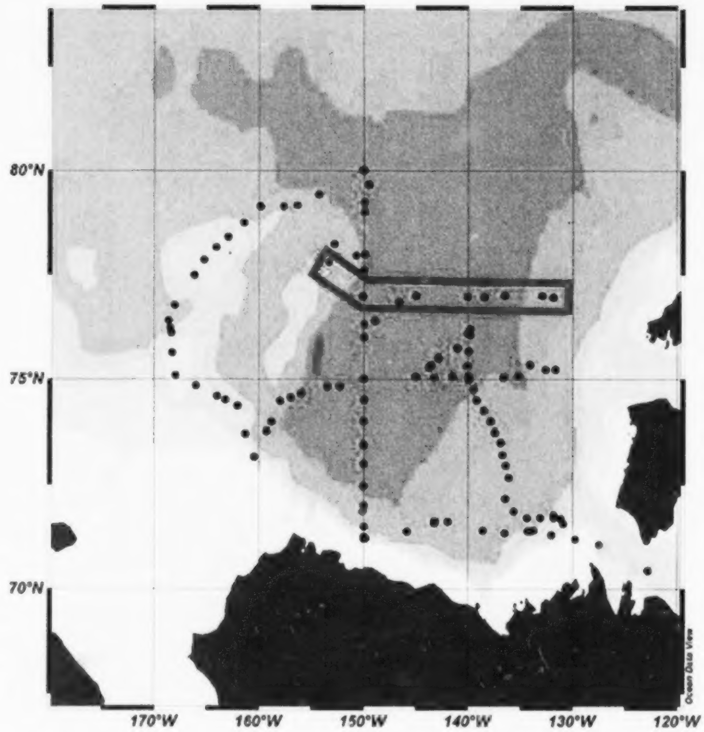
75°N Section, 0 to 1500 db, CTD Data



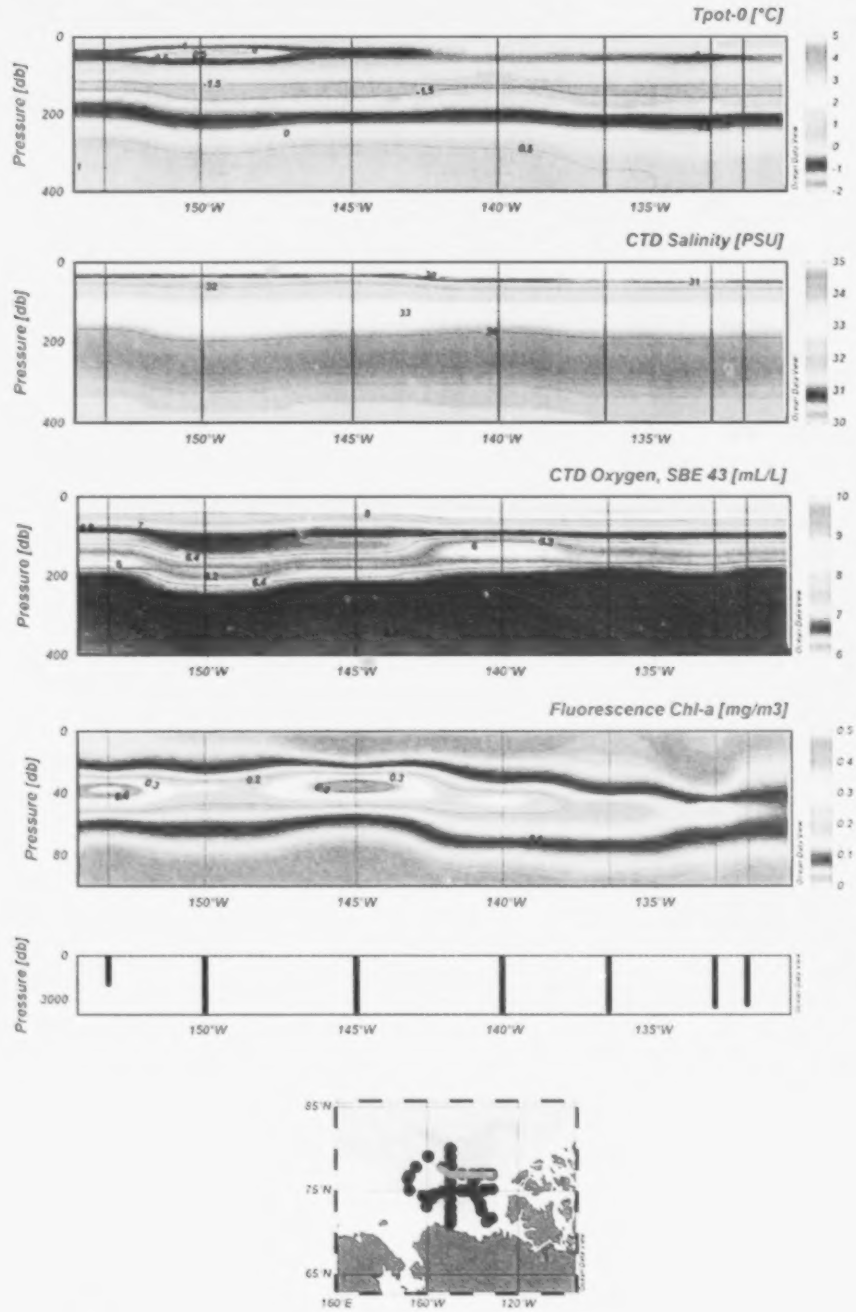
75°N Section, 0 to 1500 db, Chemistry Data



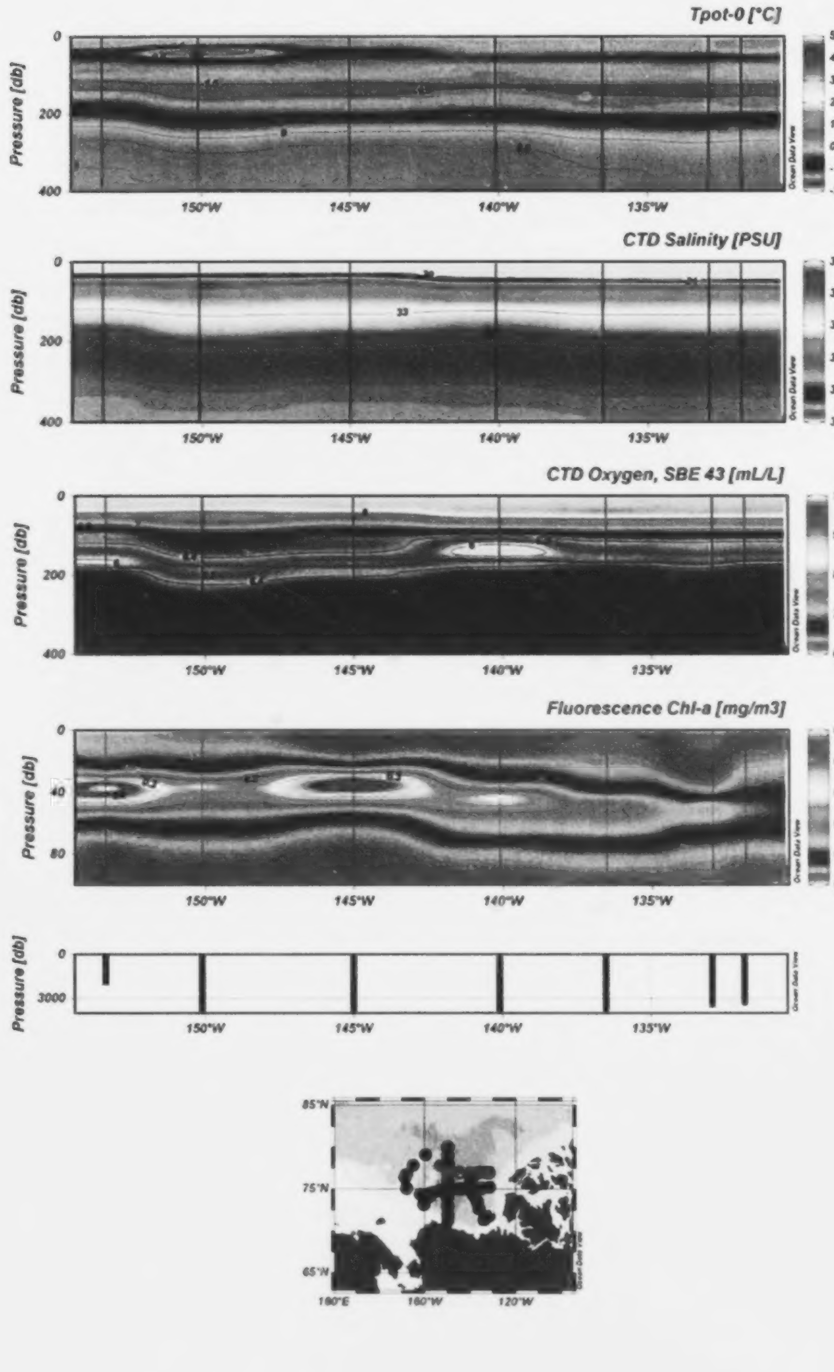
Map - 78°W Section



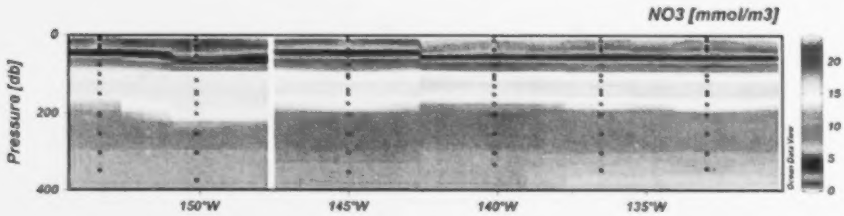
78°N Section, 0 to 400 db, CTD Data

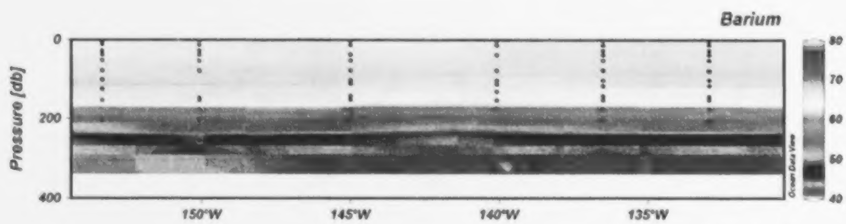


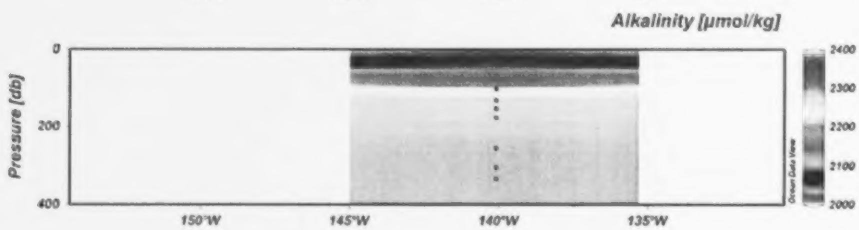
78°N Section, 0 to 400 db, CTD Data

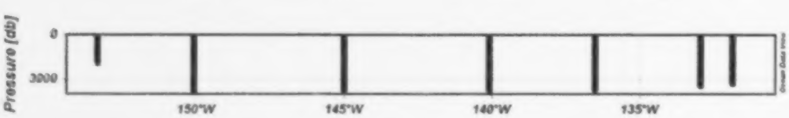


78°N Section, 0 to 400 db, Chemistry Data

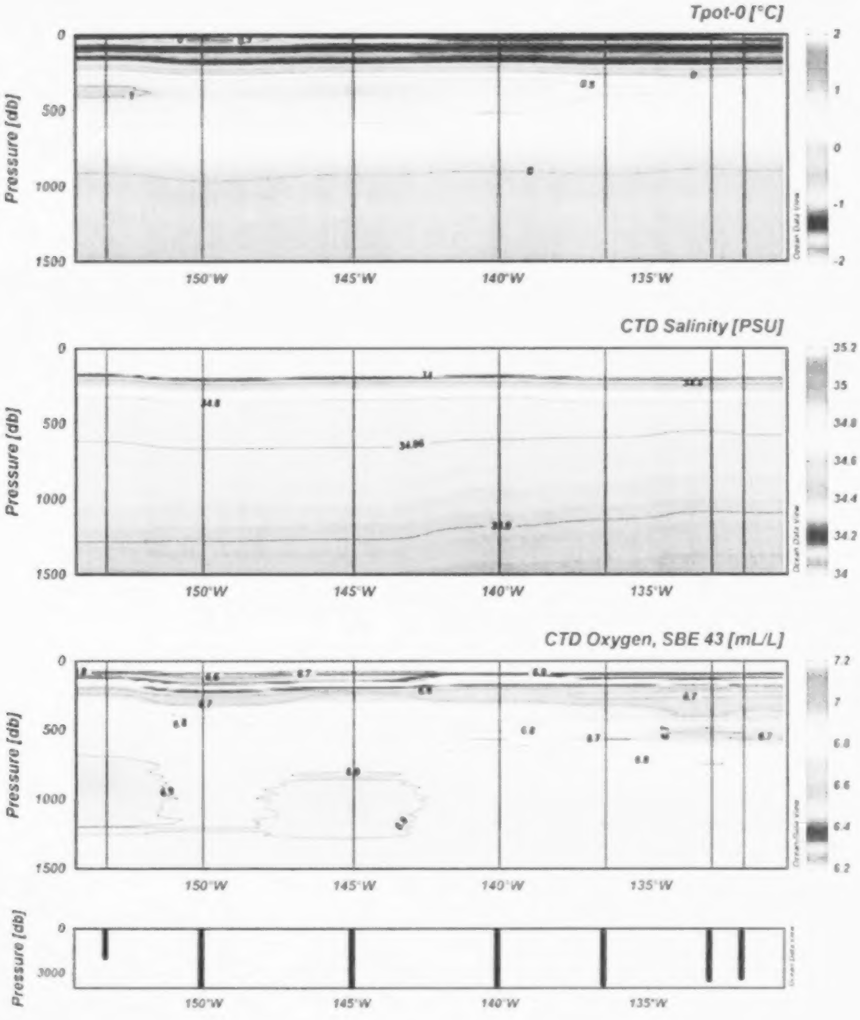


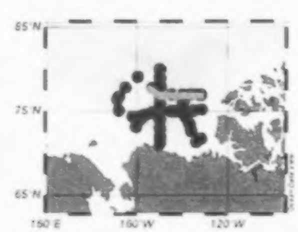




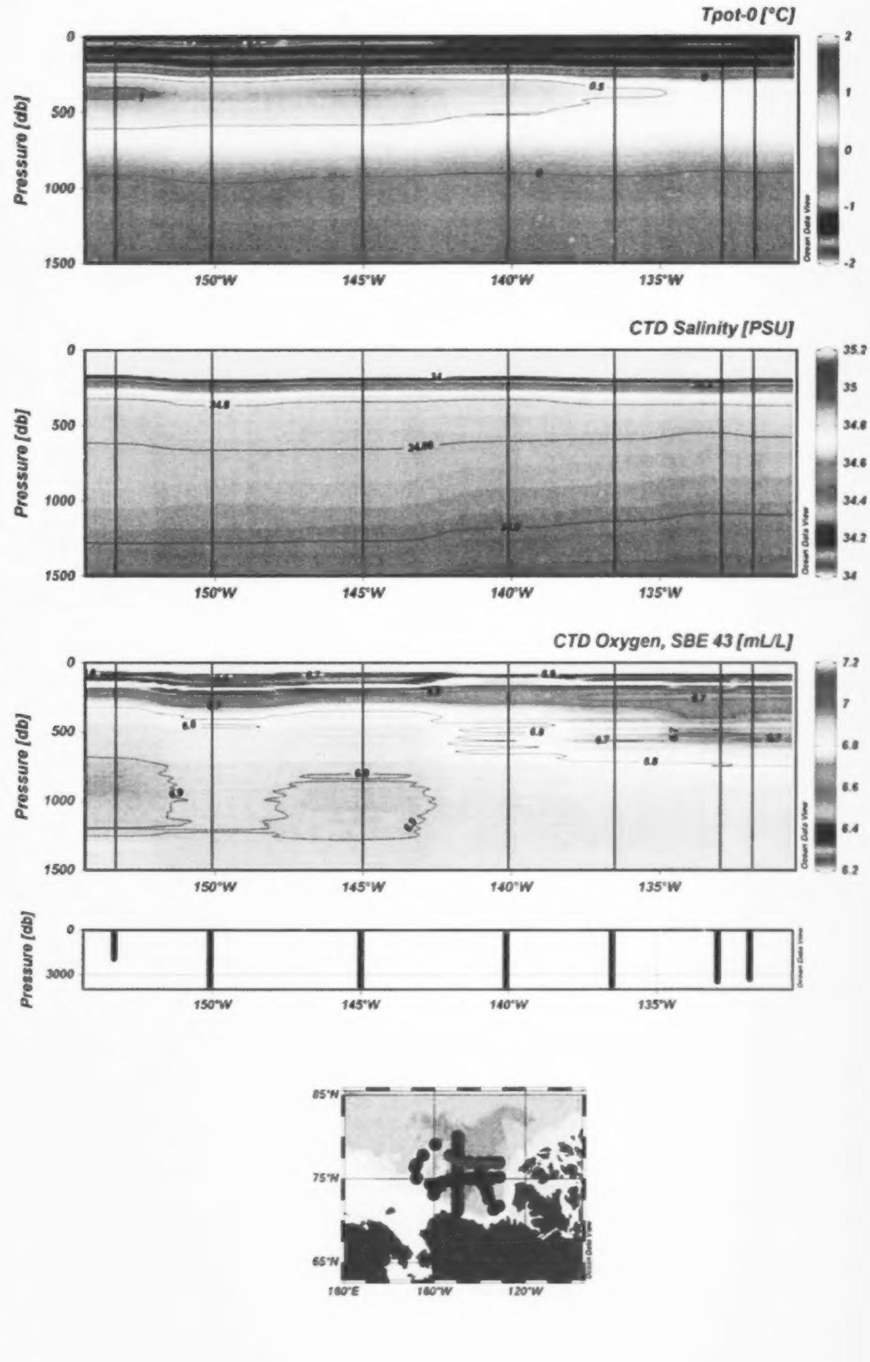


78°N Section, 0 to 1500 db, CTD Data

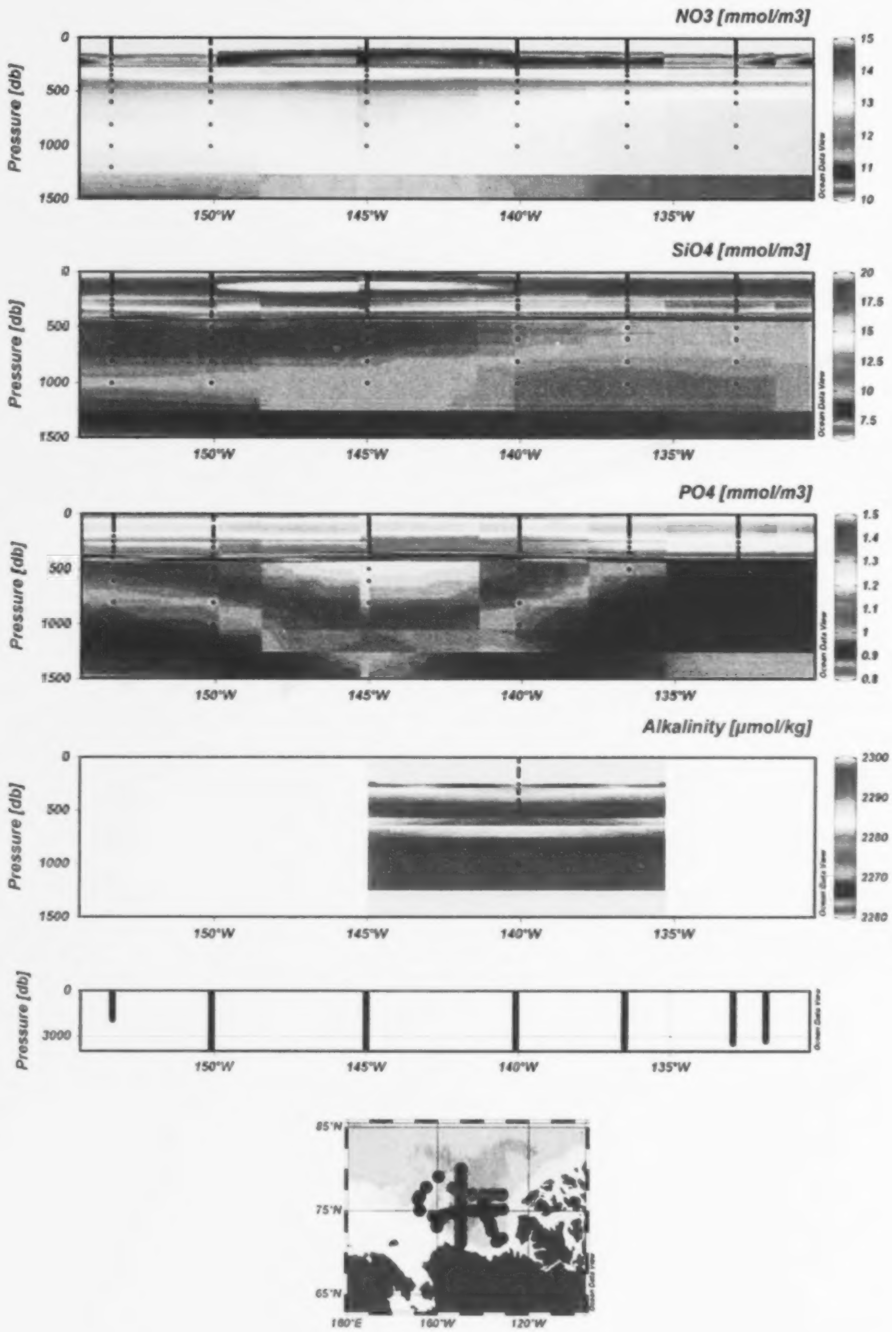




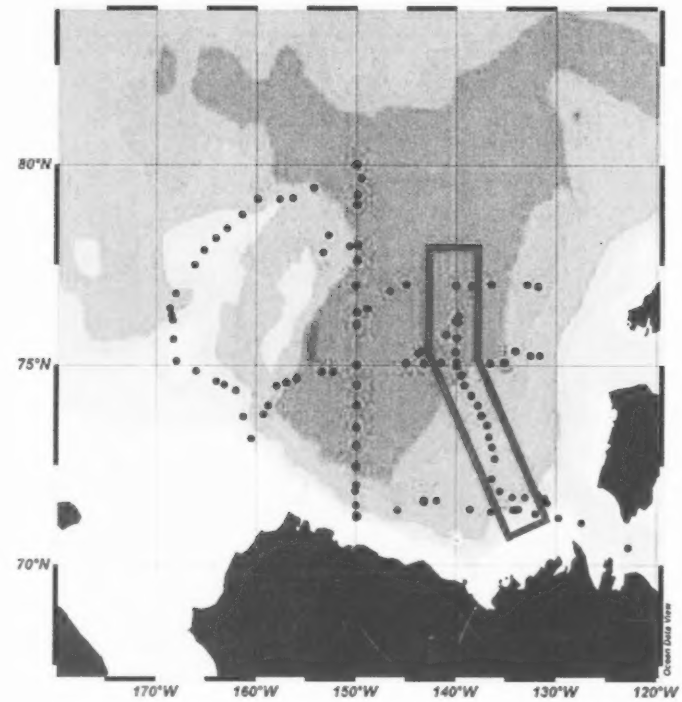
78°N Section, 0 to 1500 db, CTD Data



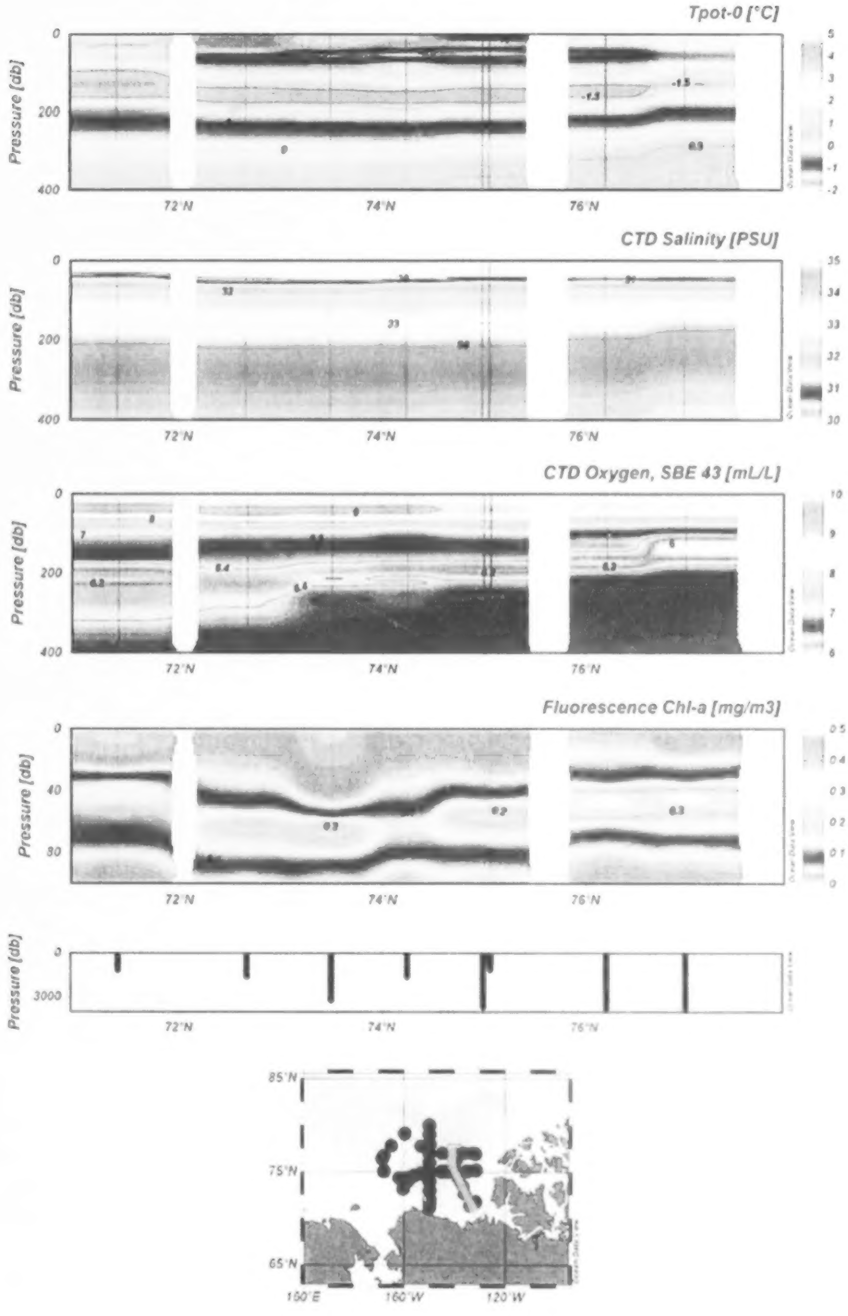
78°N Section, 0 to 1500 db, CTD Data



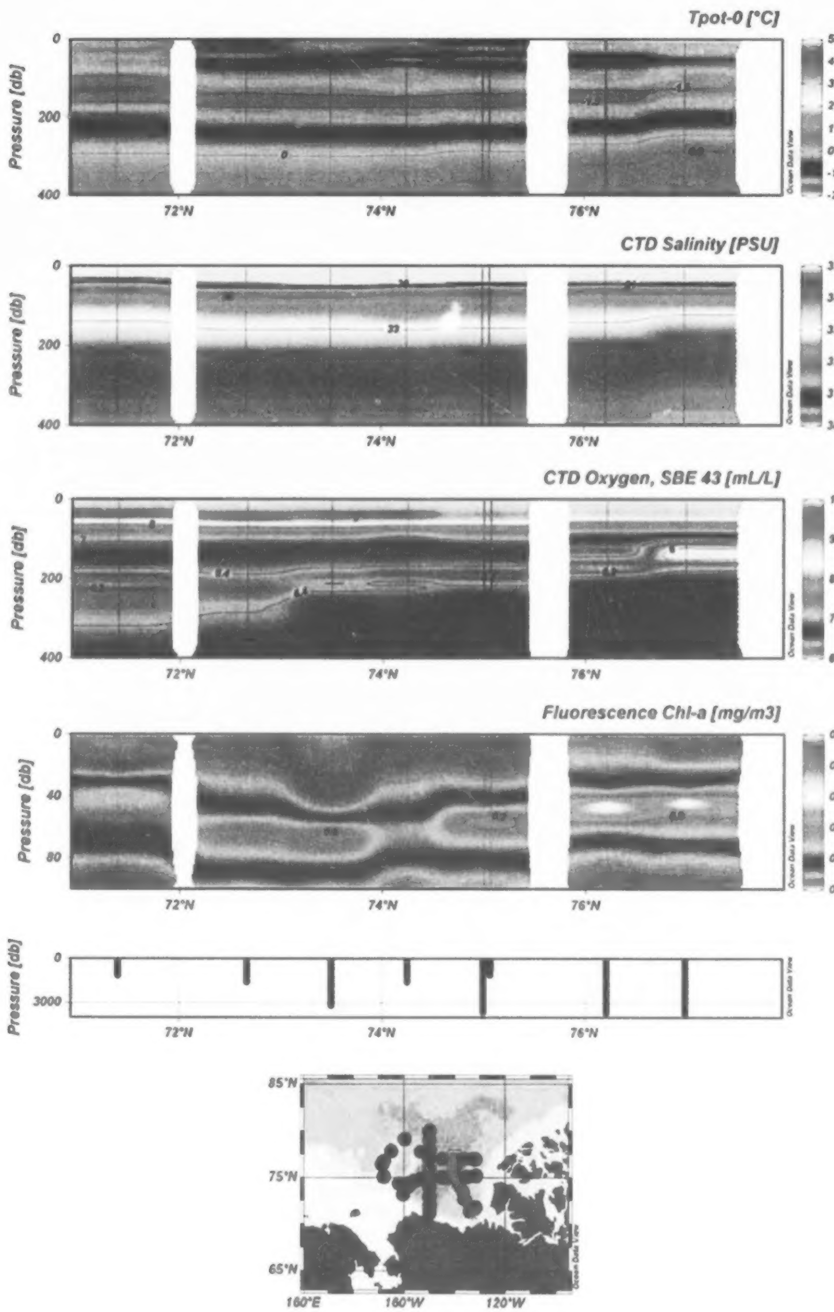
Map - 140°W Section



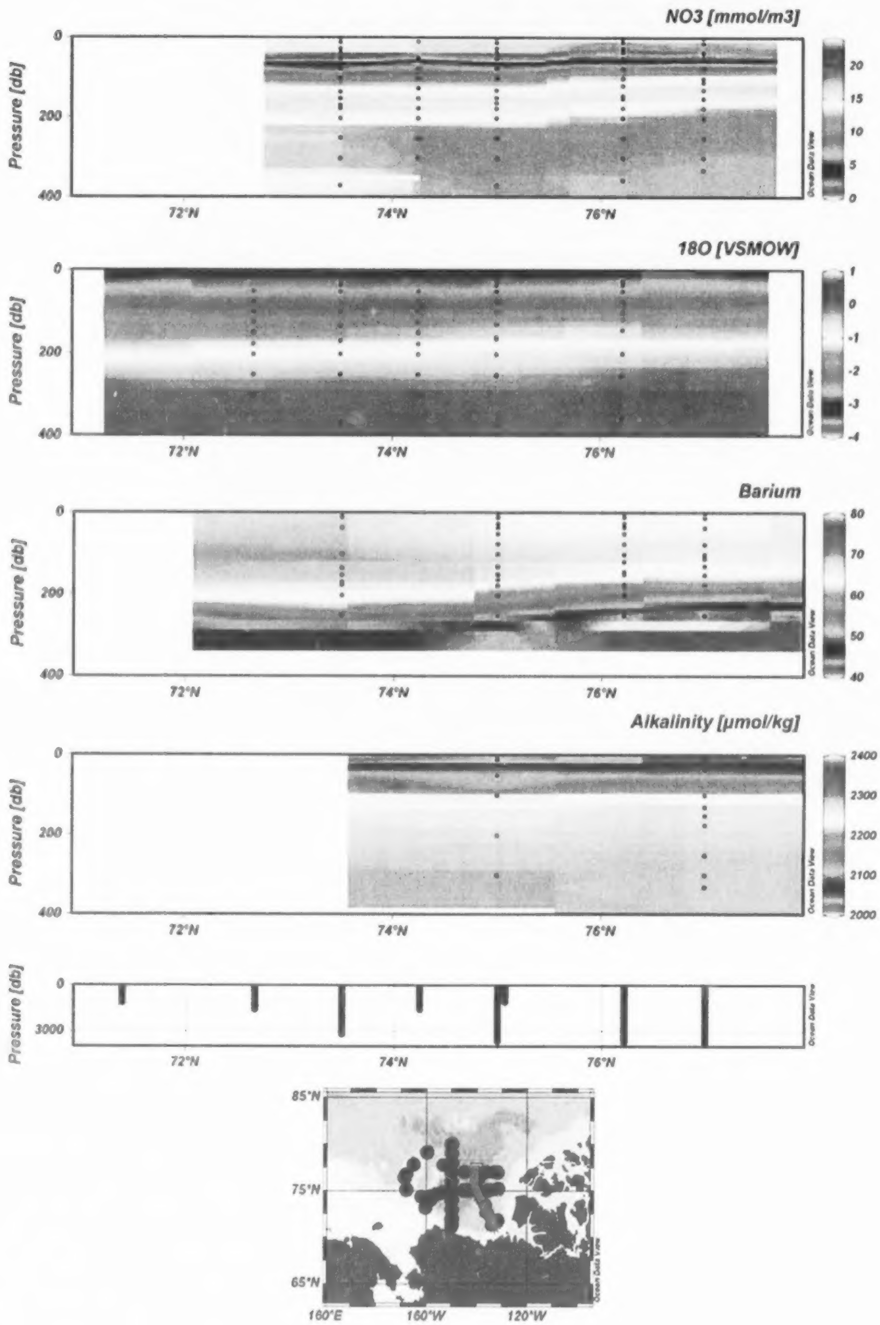
140°W Section, 0 to 400 db, CTD Data



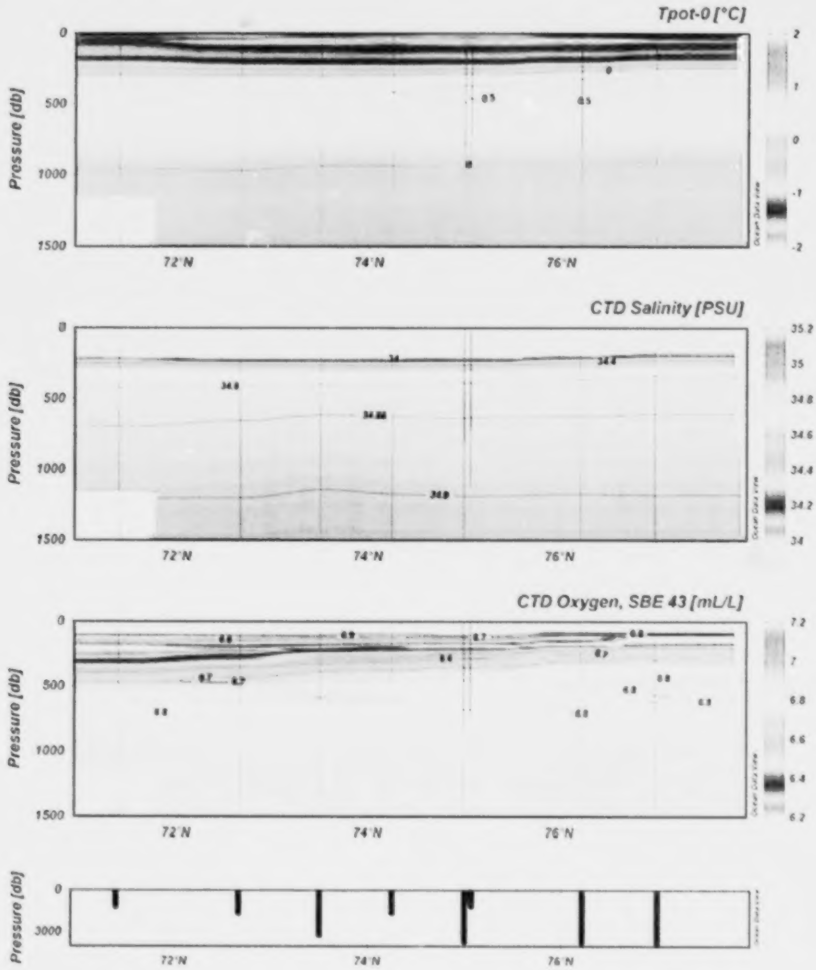
140°W Section, 0 to 400 db, CTD Data

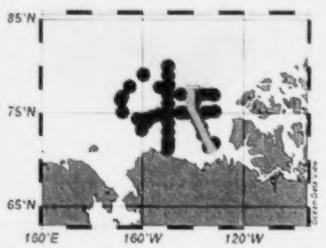


140°W Section, 0 to 400 db, Chemistry Data

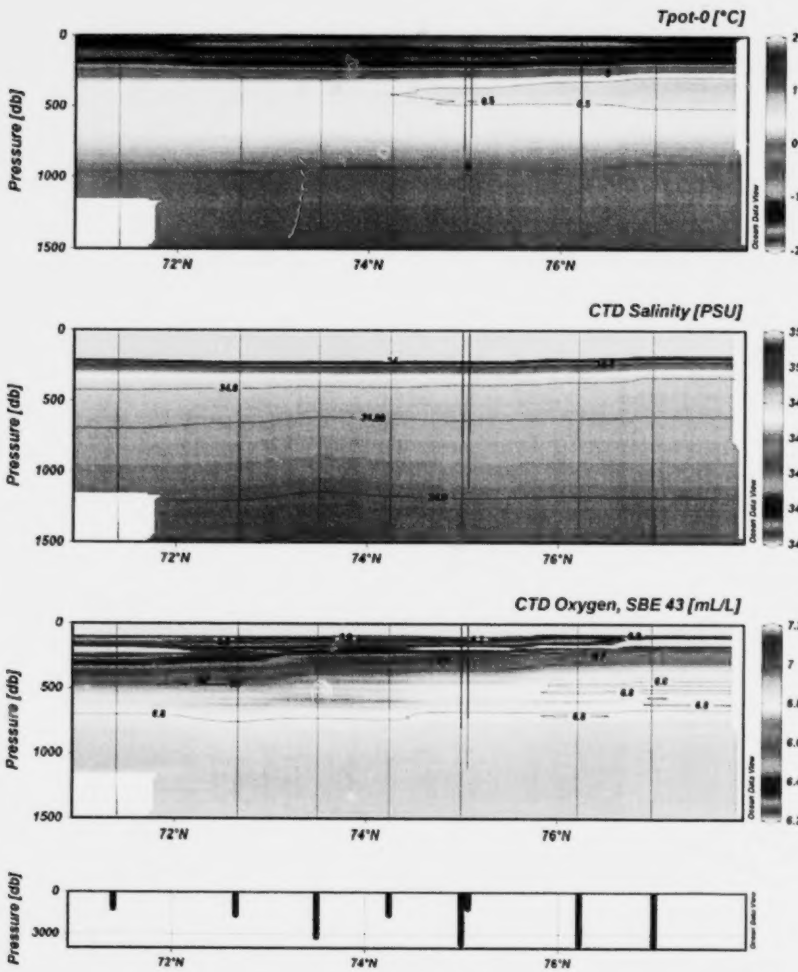


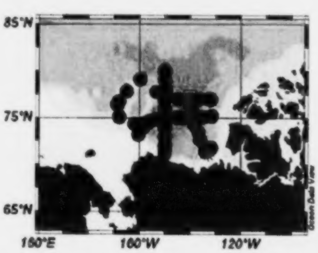
140°W Section, 0 to 1500 db, CTD Data



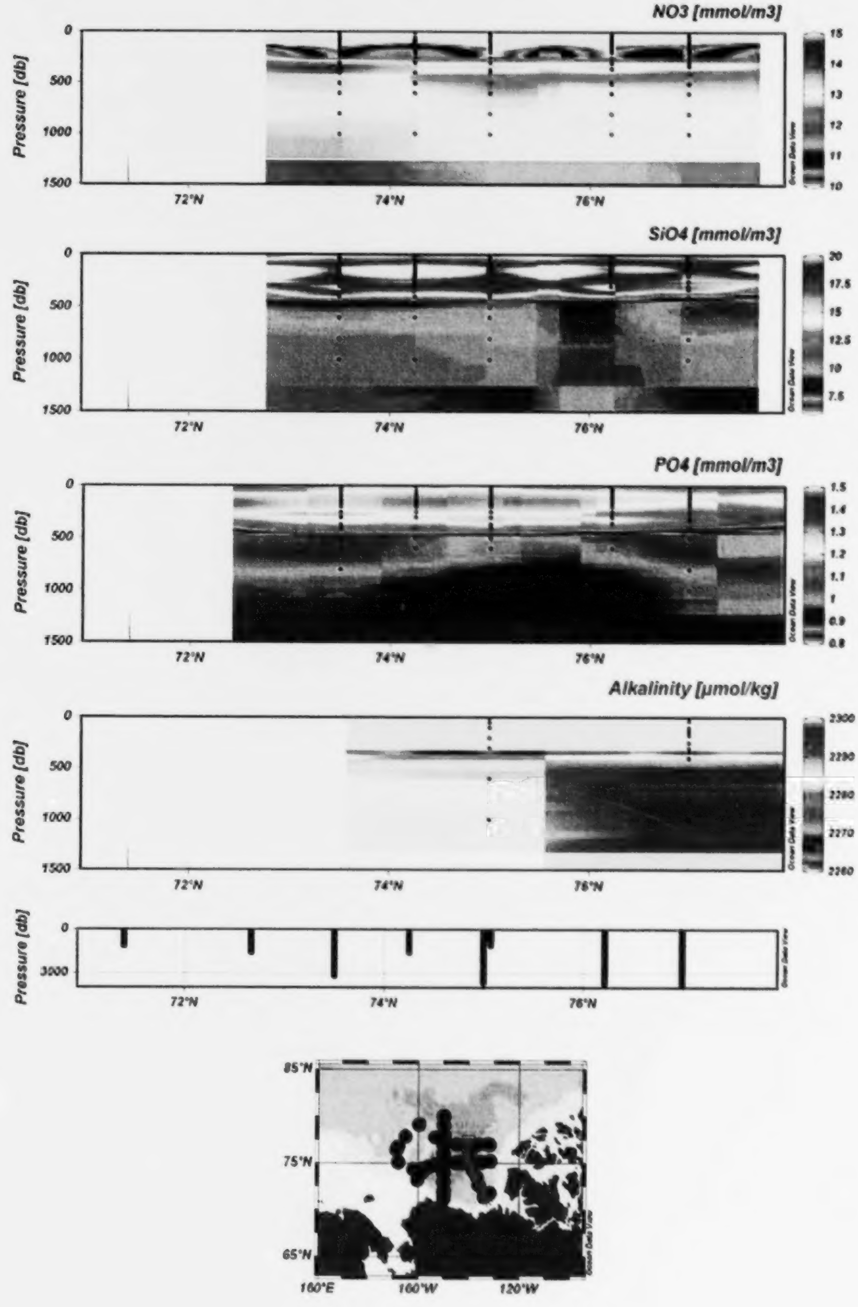


140°W Section, 0 to 1500 db, CTD Data

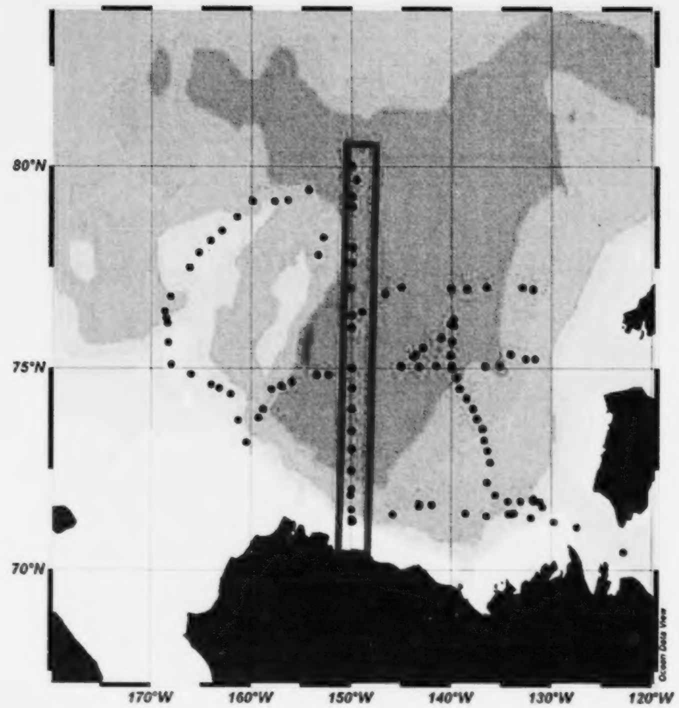




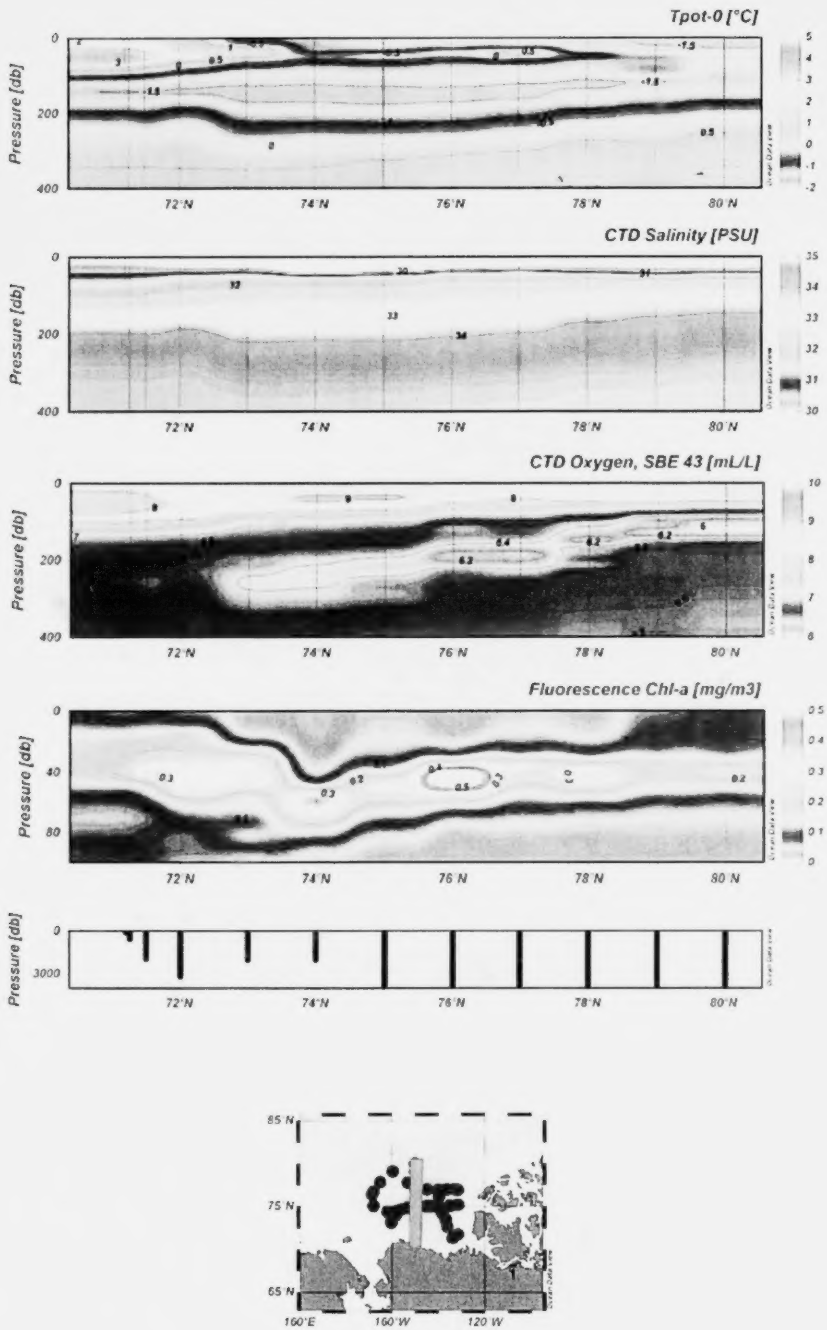
140°W Section, 0 to 1500 db, Chemistry Data



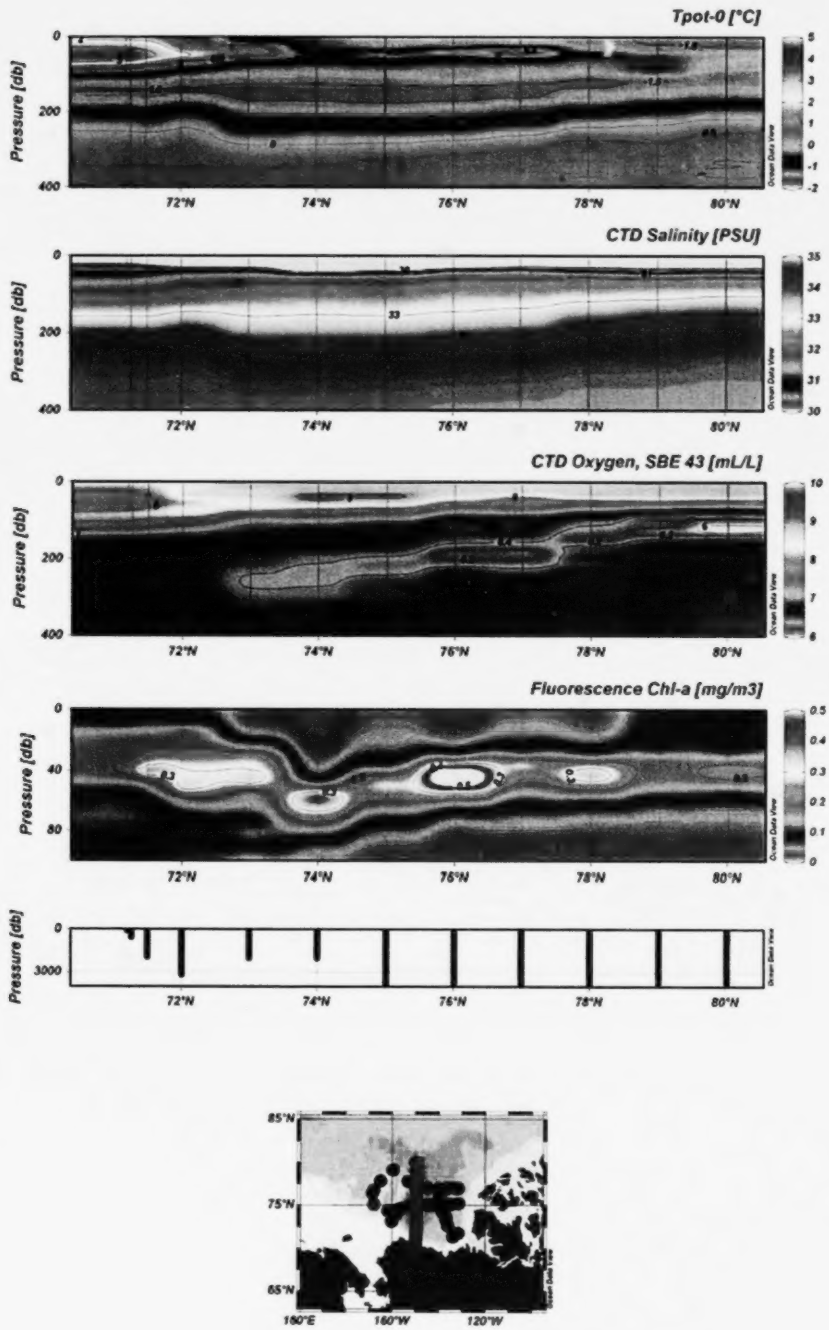
Map - 150°W Section



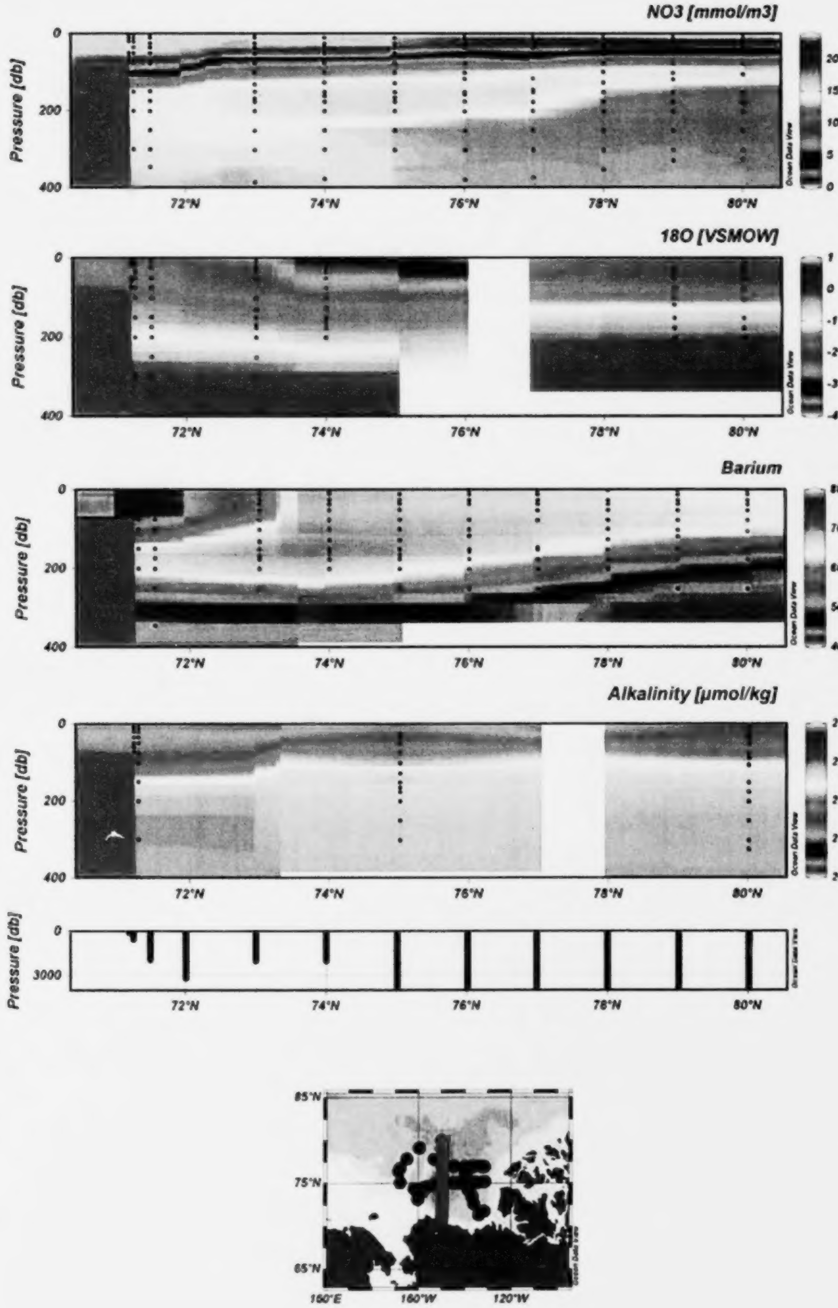
150°W Section, 0 to 400 db, CTD Data



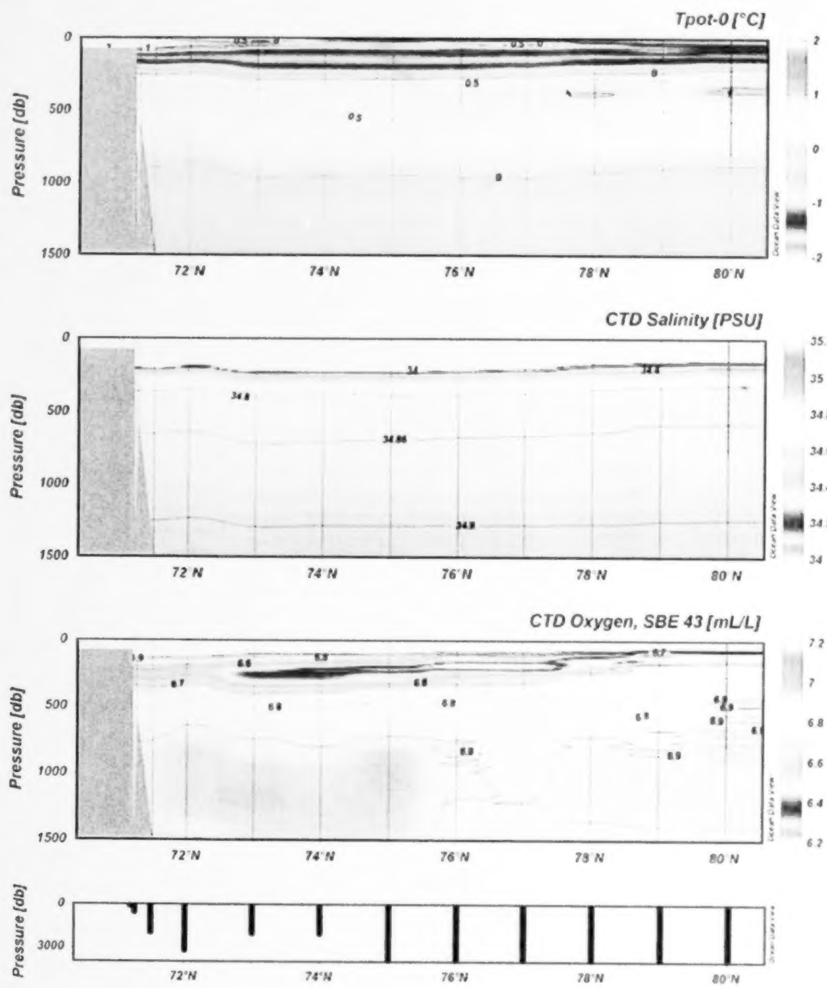
150°W Section, 0 to 400 db, CTD Data

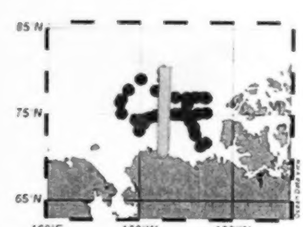


150°W Section, 0 to 400 db, Chemistry Data

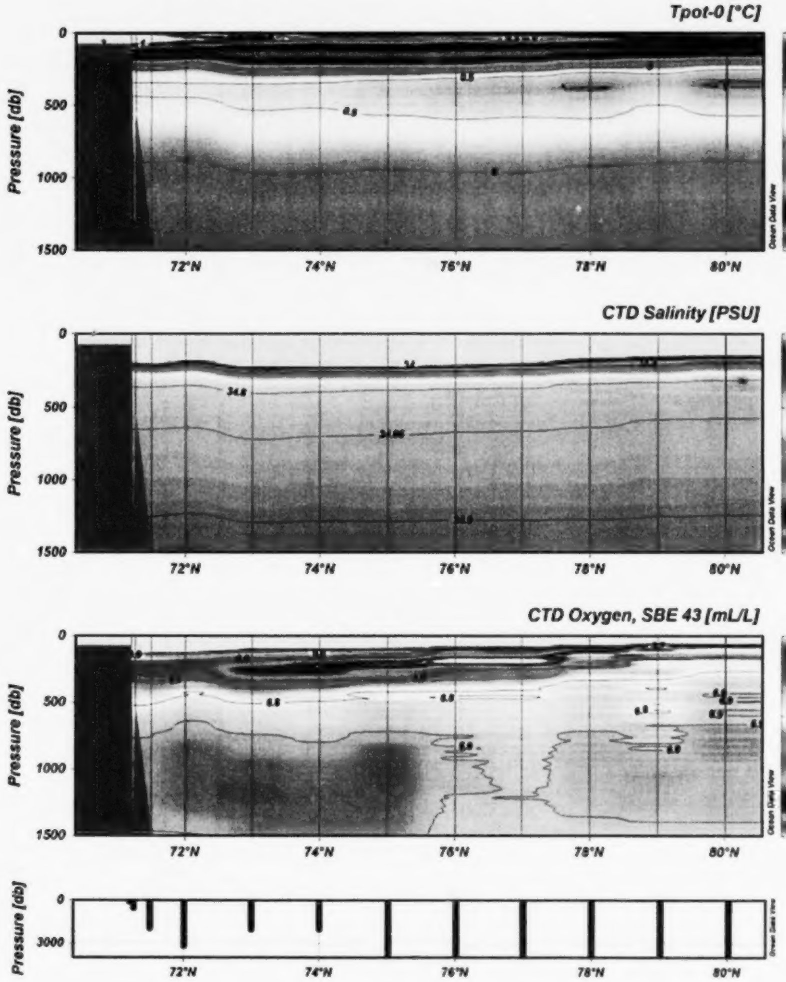


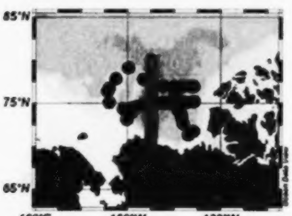
150°W Section, 0 to 1500 db, CTD Data



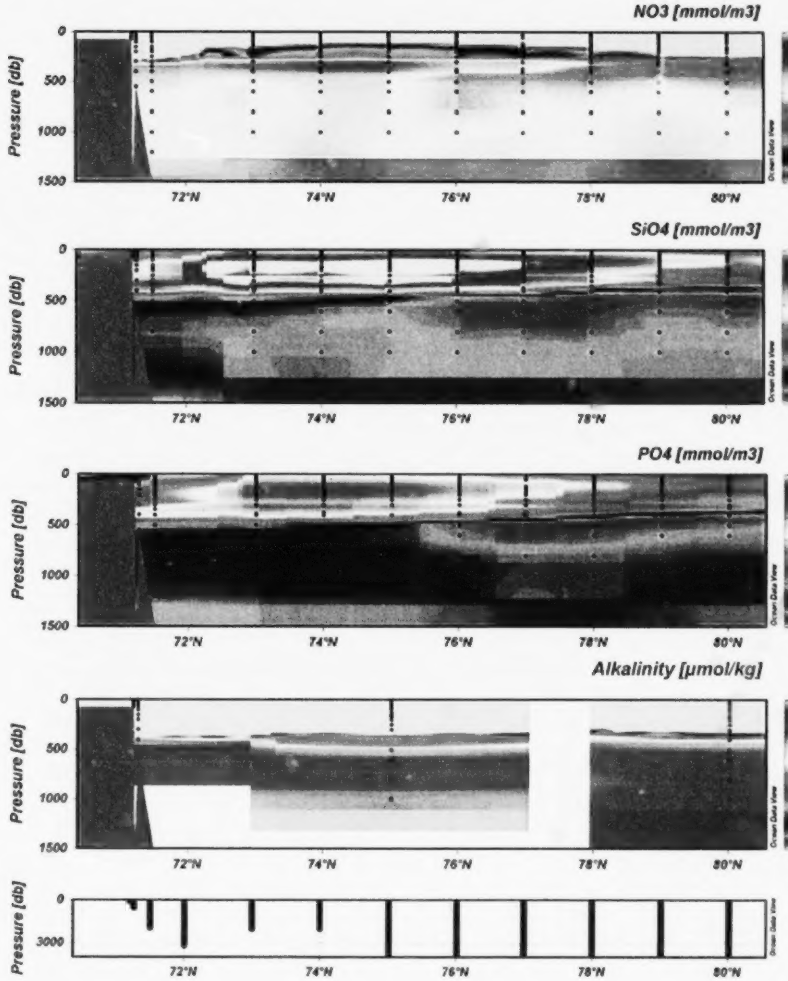


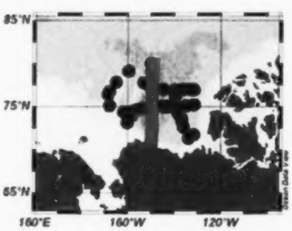
150°W Section, 0 to 1500 db, CTD Data



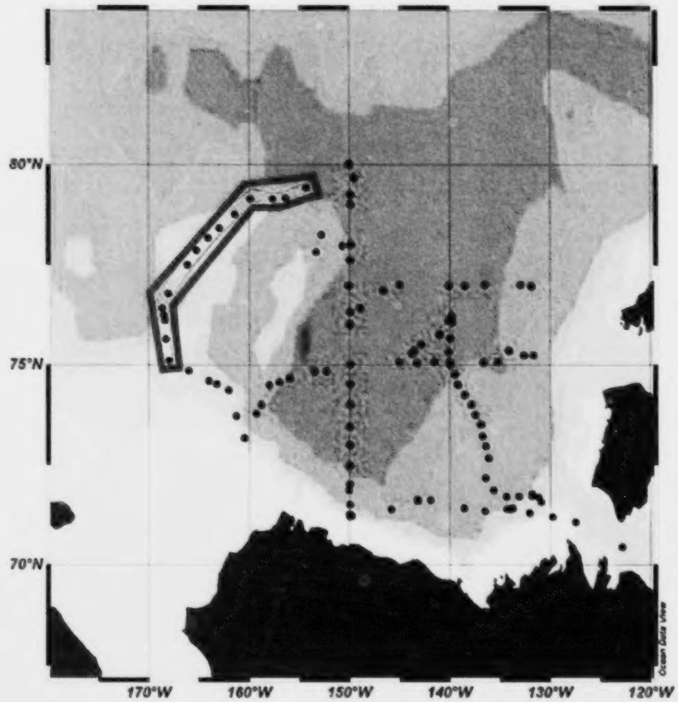


150°W Section, 0 to 1500 db, Chemistry Data

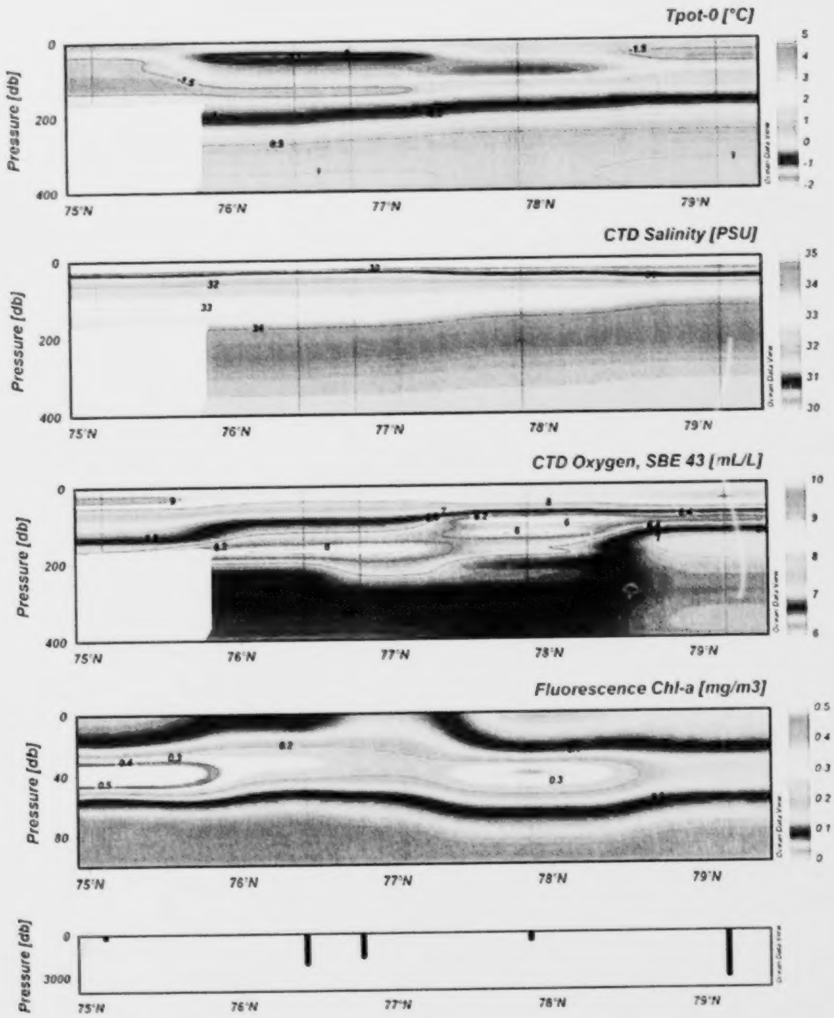


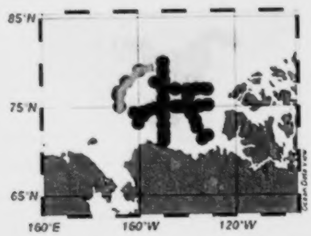


Map – Chukchi Section

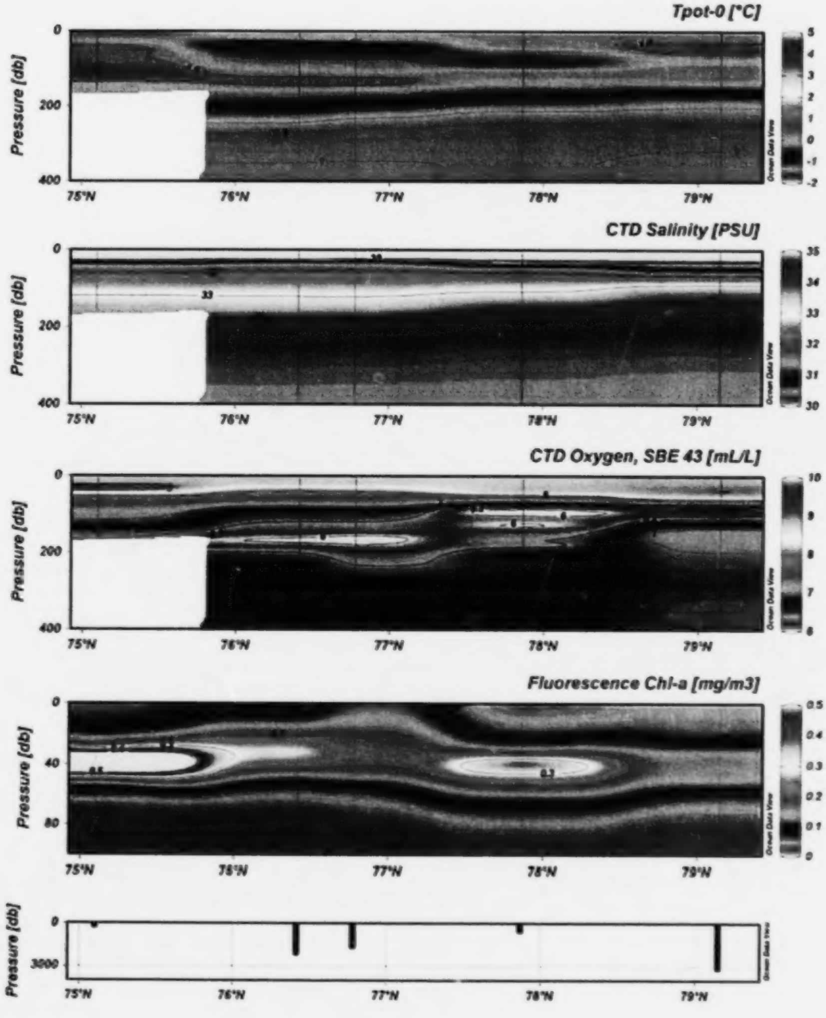


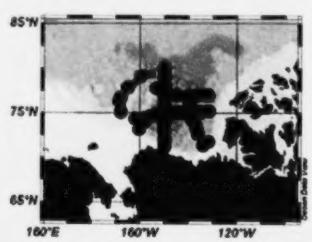
Chukchi Section, 0 to 400 db, CTD Data



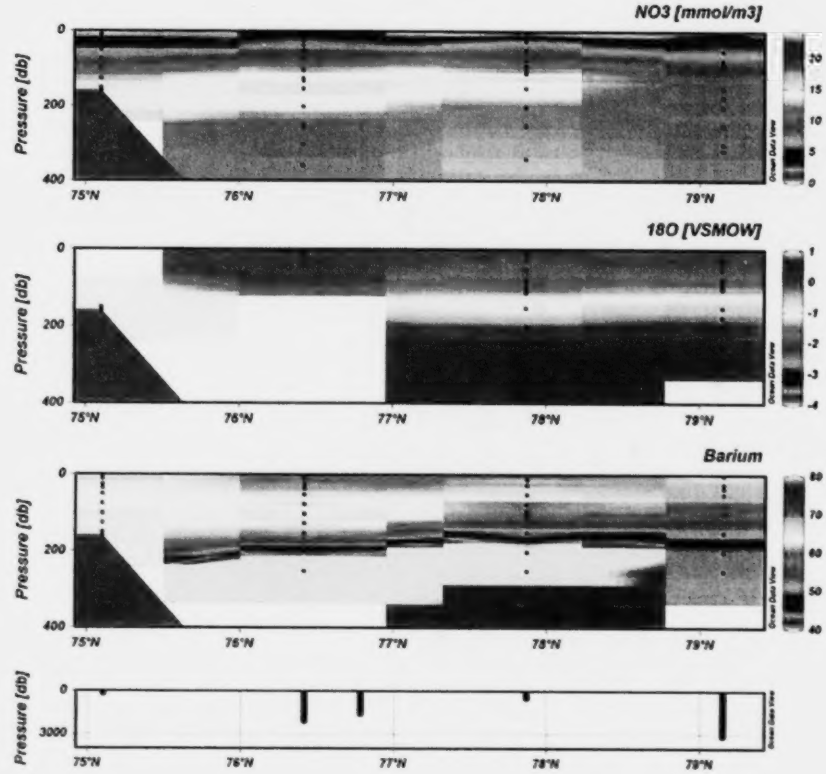


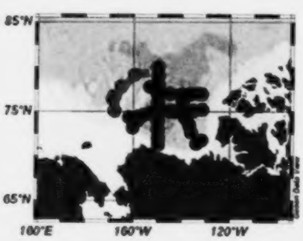
Chukchi Section, 0 to 400 db, CTD Data



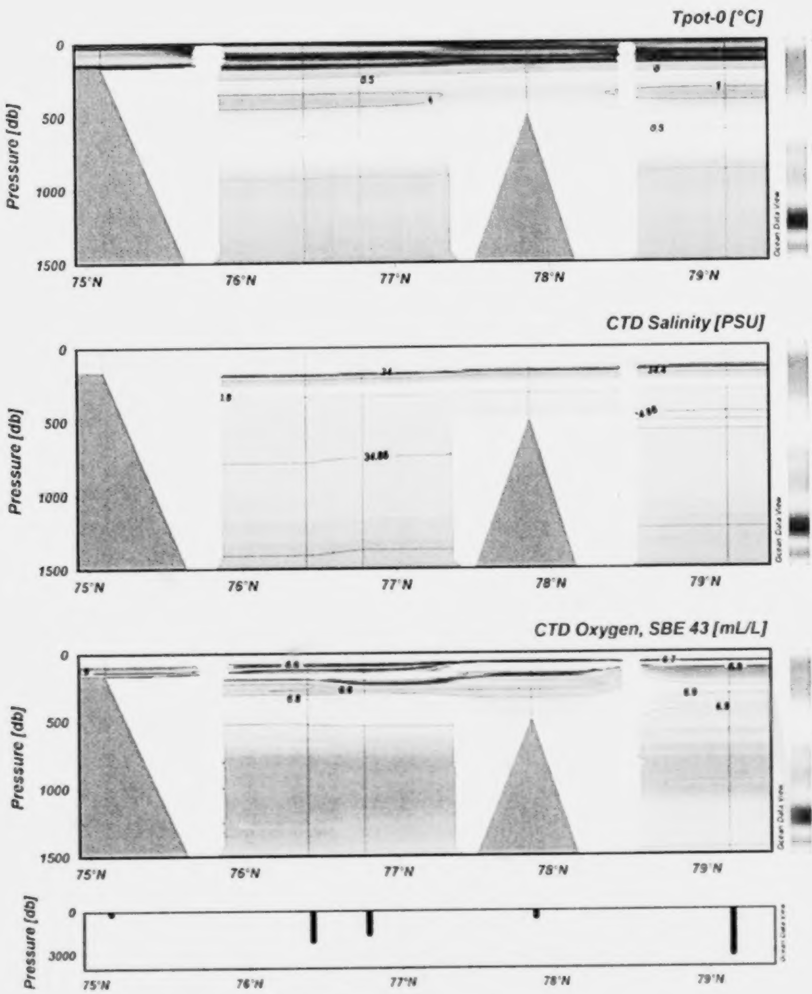


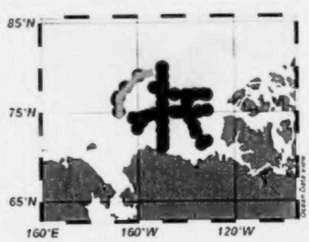
Chukchi Section, 0 to 400 db, Chemistry Data



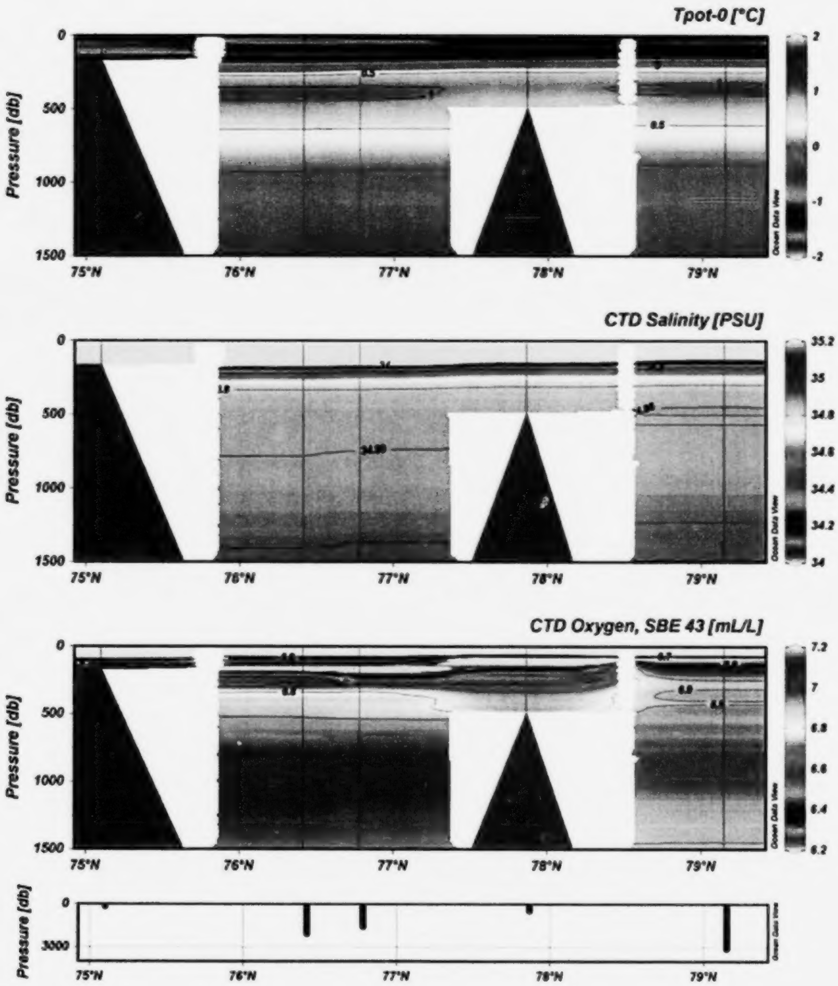


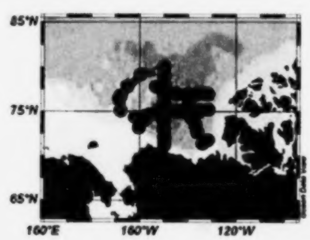
Chukchi Section, 0 to 1500 db, CTD Data



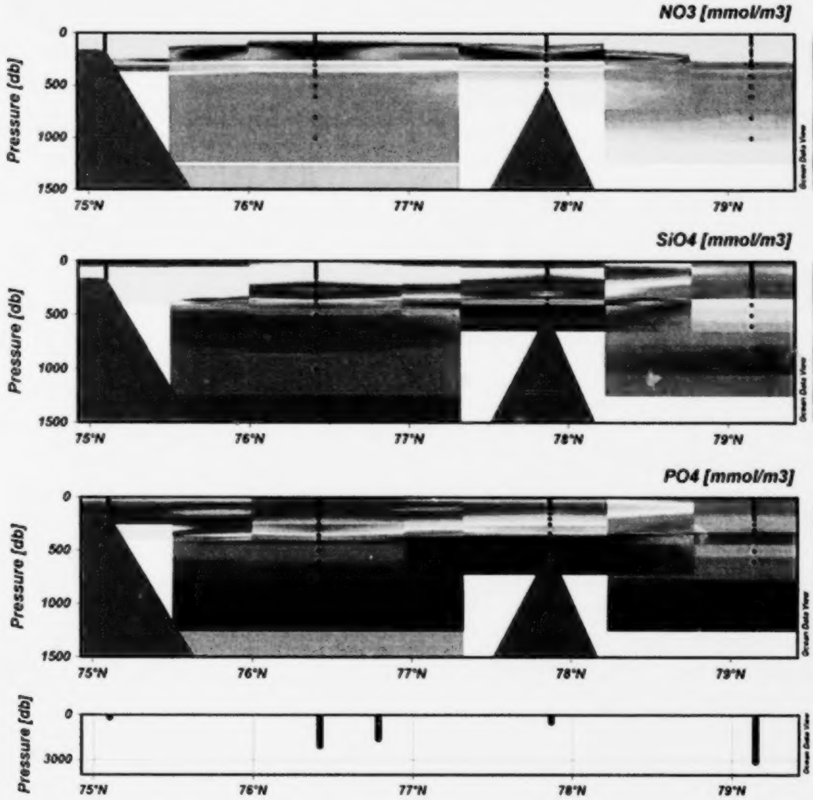


Chukchi Section, 0 to 1500 db, CTD Data





Chukchi Section, 0 to 1500 db, Chemistry Data



8. OPLANKTON IDENTIFICATION DATA

ZOOPLANKTON BENCH SHEET - Hopcroft (UAF)

LOC: Canada Basin — SAMPLE DATE: **030813** — CODE: 030813 — REP: 0
STN: **LS6** — COUNT DATE: — VOLUME (L): 28,260.00
GEAR TYPE: PugetSound 150 — MESH (µm): 150 — MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 — EFFICIENCY: 100.00% — Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.062500	4	2.26	4,313.5	711.950	1.612	0.00
8	Calan gla	0.003906	80	724.70	2,615.2	192.263	139.333	0.00
10	Calcop 1/2	0.003906	18	163.06	1,048.1	15.919	2.596	0.00
20	Pareuchaet	0.062500	1	0.57	1,409.4	31.740	0.018	0.00
32	Metrid lon	0.062500	9	5.10	2,779.9	211.181	1.076	0.00
34	Microcal	0.003906	6	54.35	525.4	2.481	0.135	0.00
44	Pseudo min	0.003906	7	63.41	1,021.0	13.299	0.843	0.00
47	Pseudo cop	0.003906	100	905.87	604.9	3.902	3.535	0.00
53	Spinocal	0.003906	14	126.82	470.6	1.680	0.213	0.00
63	Oith simi	0.003906	62	561.64	391.5	1.034	0.581	0.00
65	Oncaea	0.003906	4	36.23	383.2	0.941	0.034	0.00
73	Cal.Naup	0.003906	13	117.76	329.2	0.654	0.077	0.00
74	Cyc.Naup	0.003906	1	9.06	248.6	0.273	0.002	0.00
77	Limnacina	0.062500	7	3.96	698.5	28.562	0.113	0.00
78	oik van	0.003906	18	163.06	936.5	19.186	3.128	0.00
106	Frit. Bor	0.003906	8	72.47	390.4	2.786	0.202	0.00
111	PteropodA	1.000000	1	0.04	8,247.2	1876.920	0.066	0.00
114	Amph (P)	0.062500	1	0.57	5,349.6	751.223	0.425	0.00
115	Sagit el	0.062500	7	3.96	16,418.2	1184.062	4.693	0.00
116	Eukr ham	0.003906	18	163.06	6,288.0	169.745	27.678	0.00
119	Ostracod	0.003906	113	1,023.64	961.5	29.364	30.058	0.00
138	Barn.Naup	0.003906	3	27.18	799.7	6.721	0.183	0.00
157	MedusaeC	0.062500	4	2.26	9,604.5	3094.639	7.008	0.00
166	Poly larv	0.003906	4	36.23	1,178.1	0.000	0.000	0.00
173	CalyLrg	0.003906	1	9.06	258.2	1.639	0.015	0.00
179	??	0.003906	4	36.23	560.5	2.564	0.093	0.00
			508	4,312.56			223.718	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030813** CODE: 030813 REP: 0
STN: **LS7** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: PugetSound 150 MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	19	5.38	5,866.3	1734.191	9.328	0.00
8	Calan gla	0.125000	10	2.83	3,139.9	318.425	0.901	0.00
10	Calcop 1/2	0.007813	1	4.53	1,050.4	14.182	0.064	0.00
20	Pareuchaet	0.125000	8	2.26	3,013.2	381.462	0.864	0.00
32	Metrid lon	0.125000	1	0.28	1,860.1	67.885	0.019	0.00
34	Microcal	0.007813	23	104.18	435.3	1.381	0.144	0.00
44	Pseudo min	0.007813	3	13.59	1,006.0	12.674	0.172	0.00
47	Pseudo cop	0.007813	21	95.12	403.2	1.175	0.112	0.00
51	Scol minor	0.125000	3	0.85	1,155.4	19.168	0.016	0.00
63	Oith simi	0.007813	53	240.06	396.2	1.082	0.260	0.00
65	Oncaea	0.007813	5	22.65	374.0	0.848	0.019	0.00
73	Cal.Naup	0.007813	5	22.65	346.7	0.721	0.016	0.00
77	Limnacina	0.125000	32	9.06	261.0	1.975	0.018	0.00
78	oik van	0.007813	1	4.53	121.8	0.050	0.000	0.00
106	Frit. Bor	0.007813	12	54.35	296.4	1.479	0.080	0.00
116	Eukr ham	0.125000	11	3.11	9,220.6	437.117	1.361	0.00
119	Ostracod	0.125000	27	7.64	965.4	29.575	0.226	0.00
157	MedusaeC	1.000000	4	0.14	8,835.5	2247.043	0.318	0.00
			239	593.21			13.919	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030814** CODE: 030814 REP: 0
STN: **LS9** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: PugetSound 150 MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	40	181.17	5,083.8	1360.210	246.436	0.00
8	Calan gla	0.125000	11	3.11	3,506.5	413.131	1.286	0.00
10	Calcop 1/2	0.125000	1	0.28	1,403.7	31.385	0.009	0.00
20	Pareuchaet	0.125000	3	0.85	4,199.6	917.547	0.779	0.00
32	Metrid lon	0.007813	1	4.53	2,780.2	204.178	0.925	0.00
34	Microcal	0.007813	7	31.71	433.8	1.407	0.045	0.00
47	Pseudo cop	0.007813	57	258.17	423.1	1.272	0.328	0.00
63	Oith simi	0.007813	110	498.23	381.3	0.983	0.490	0.00
65	Oncaea	0.007813	13	58.88	359.4	0.766	0.045	0.00
73	Cal.Naup	0.007813	13	58.88	265.7	0.350	0.021	0.00
77	Limnacina	0.007813	1	4.53	486.2	6.712	0.030	0.00
103	Oiko.sp	0.125000	2	0.57	750.5	4.756	0.003	0.00
106	Frit. Bor	0.007813	2	9.06	619.0	7.627	0.069	0.00
114	Amph (P)	0.125000	1	0.28	7,816.2	1628.208	0.461	0.00
116	Eukr ham	0.125000	6	1.70	10,282.4	466.074	0.792	0.00
119	Ostracod	0.007813	4	18.12	2,052.3	197.219	3.573	0.00
157	MedusaeC	0.125000	1	0.28	9,717.3	2538.614	0.719	0.00
			273	1,130.36			256.010	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin   SAMPLE DATE: **030820**   CODE: 030820   REP: 0
STN: **LS1**   COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: PugetSound 150   MESH (µm): 150   MOUTH DIA (m): 0.600
DISTANCE (m): 100.0   EFFICIENCY: 100.00%   Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	27	122.29	4,294.5	884.566	108.176	0.00
8	Calan gla	0.062500	10	5.66	3,707.8	471.429	2.669	0.00
10	Calcop 1/2	0.007813	10	45.29	1,074.6	17.394	0.788	0.00
20	Pareuchaet	0.062500	2	1.13	4,088.8	587.485	0.665	0.00
32	Metrid lon	0.007813	10	45.29	1,992.5	91.163	4.129	0.00
34	Microcal	0.007813	6	27.18	495.4	1.855	0.050	0.00
47	Pseudo cop	0.007813	23	104.18	434.2	1.352	0.141	0.00
63	Oith simi	0.007813	45	203.82	424.6	1.240	0.253	0.00
65	Oncaea	0.007813	6	27.18	382.8	0.904	0.025	0.00
73	Cal.Naup	0.007813	4	18.12	336.1	0.677	0.012	0.00
77	Limnacina	0.007813	15	67.94	400.5	4.673	0.317	0.00
103	Oiko.sp	0.062500	5	2.83	417.1	1.321	0.004	0.00
106	Frit. Bor	0.007813	28	126.82	412.4	3.259	0.413	0.00
114	Amph (P)	0.062500	1	0.57	2,986.9	228.797	0.130	0.00
116	Eukr ham	0.062500	1	0.57	9,593.8	324.411	0.184	0.00
119	Ostracod	0.007813	4	18.12	1,207.7	70.746	1.282	0.00
157	MedusaeC	1.000000	1	0.04	14,424.9	5683.131	0.201	0.00
			198	817.02			119.439	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030821** CODE: 030821 REP: 0
STN: **L21** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: PugetSound 150 MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	11	3.11	4,386.3	991.607	3.088	0.00
8	Calan gla	0.007813	5	22.65	3,544.9	402.412	9.113	0.00
10	Calcop 1/2	0.007813	10	45.29	1,197.9	21.833	0.989	0.00
20	Pareuchaet	0.125000	4	1.13	2,723.8	329.477	0.373	0.00
32	Metrid lon	0.007813	6	27.18	1,964.9	87.201	2.370	0.00
34	Microcal	0.007813	14	63.41	468.0	1.641	0.104	0.00
47	Pseudo cop	0.007813	15	67.94	398.4	1.022	0.069	0.00
53	Spinocal	0.007813	2	9.06	376.0	0.945	0.009	0.00
63	Oith simi	0.007813	18	81.53	416.8	1.192	0.097	0.00
65	Oncaea	0.007813	5	22.65	411.6	1.099	0.025	0.00
73	Cal.Naup	0.007813	9	40.76	348.4	0.789	0.032	0.00
77	Limnacina	0.007813	31	140.41	383.4	4.268	0.599	0.00
78	oik van	0.125000	2	0.57	603.4	2.790	0.002	0.00
79	cop?	0.125000	1	0.28	2,200.0	107.513	0.030	0.00
106	Frit. Bor	0.007813	9	40.76	537.1	5.810	0.237	0.00
116	Eukr ham	0.125000	3	0.85	12,707.1	726.541	0.617	0.00
157	MedusaeC	1.000000	3	0.11	10,186.9	2814.343	0.299	0.00
			148	567.69			18.053	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030823** CODE: 030823 REP: 0
STN: **LS2** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	29	131.35	3,588.5	729.918	95.876	0.00
8	Calan gla	0.125000	14	3.96	3,029.8	322.932	1.280	0.00
10	Calcop 1/2	0.007813	31	140.41	1,054.7	16.855	2.367	0.00
20	Pareuchaet	0.007813	1	4.53	3,430.4	363.150	1.645	0.00
32	Metrid lon	0.125000	5	1.42	2,448.0	155.831	0.221	0.00
34	Microcal	0.007813	7	31.71	500.0	1.896	0.060	0.00
47	Pseudo cop	0.007813	22	99.65	443.8	1.575	0.157	0.00
63	Oith simi	0.007813	43	194.76	426.4	1.266	0.247	0.00
65	Oncaea	0.007813	10	45.29	353.0	0.737	0.033	0.00
73	Cal.Naup	0.007813	11	49.82	306.5	0.543	0.027	0.00
77	Limnacina	0.007813	5	22.65	524.0	7.913	0.179	0.00
106	Frit. Bor	0.007813	7	31.71	823.7	31.674	1.004	0.00
107	Batho/Meso	0.125000	1	0.28	2,179.4	104.778	0.030	0.00
116	Eukr ham	0.125000	4	1.13	14,774.6	920.008	1.042	0.00
119	Ostracod	0.007813	5	22.65	955.5	29.679	0.672	0.00
			195	781.32			104.839	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin   SAMPLE DATE: **030824**   CODE: 030824   REP: 0
STN: **L25**   COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm   MESH (µm): 150   MOUTH DIA (m): 0.600
DISTANCE (m): 100.0   EFFICIENCY: 100.00%   Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	55	15.57	3,094.4	429.492	6.687	0.00
8	Calan gla	0.125000	3	0.85	2,295.2	189.141	0.161	0.00
10	Calcop 1/2	0.125000	16	4.53	944.3	13.275	0.060	0.00
20	Pareuchaet	0.125000	4	1.13	3,968.7	845.642	0.958	0.00
32	Metrid lon	0.125000	3	0.85	2,036.4	87.336	0.074	0.00
34	Microcal	0.007813	29	131.35	467.5	1.638	0.215	0.00
47	Pseudo cop	0.007813	37	167.59	404.3	1.130	0.189	0.00
51	Scol minor	0.125000	1	0.28	1,096.4	15.948	0.005	0.00
53	Spinocal	0.007813	2	9.06	373.6	0.838	0.008	0.00
63	Oith simi	0.007813	90	407.64	368.9	0.907	0.370	0.00
65	Oncaea	0.007813	35	158.53	347.0	0.707	0.112	0.00
73	Cal.Naup	0.007813	44	199.29	329.9	0.716	0.143	0.00
77	Limnacina	0.125000	21	5.94	587.8	10.207	0.061	0.00
78	oik van	0.125000	6	1.70	722.9	6.389	0.011	0.00
106	Frit. Bor	0.007813	14	63.41	334.6	1.923	0.122	0.00
114	Amph (P)	0.125000	1	0.28	12,965.8	4572.039	1.294	0.00
115	Sagit el	0.125000	1	0.28	28,712.3	3462.807	0.980	0.00
116	Eukr ham	0.125000	4	1.13	8,364.8	270.391	0.306	0.00
119	Ostracod	0.125000	4	1.13	829.7	22.656	0.026	0.00
			370	1,170.56			11.781	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030824** CODE: 030824 REP: 0
STN: **LS2** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600

DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	31	8.78	3,050.2	372.883	3.272	0.00
8	Calan gla	0.125000	7	1.98	2,530.4	182.675	0.362	0.00
10	Calcop 1/2	0.003906	22	199.29	1,003.8	13.786	2.747	0.00
32	Metrid lon	0.125000	3	0.85	2,260.4	127.438	0.108	0.00
34	Microcal	0.003906	1	9.06	551.5	2.427	0.022	0.00
47	Pseudo cop	0.003906	26	235.53	448.8	1.503	0.354	0.00
63	Oith simi	0.003906	33	298.94	402.6	1.108	0.331	0.00
65	Oncaea	0.003906	11	99.65	353.3	0.779	0.078	0.00
73	Cal.Naup	0.003906	6	54.35	346.7	0.713	0.039	0.00
77	Limnacina	0.003906	1	9.06	545.9	8.450	0.077	0.00
103	Oiko.sp	0.125000	5	1.42	778.2	6.542	0.009	0.00
106	Frit. Bor	0.003906	4	36.23	372.0	2.243	0.081	0.00
116	Eukr ham	0.125000	5	1.42	11,165.5	521.843	0.739	0.00
157	MedusaeC	0.125000	2	0.57	9,162.8	2333.989	1.321	0.00
			157	957.11			9.541	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030825** CODE: 030825 REP: 0
STN: **L26** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	39	176.65	4,218.5	928.236	163.969	0.00
8	Calan gla	0.007813	8	36.23	2,392.4	186.017	6.740	0.00
10	Calcop 1/2	0.007813	51	231.00	1,121.5	18.065	4.173	0.00
20	Pareuchaet	0.007813	1	4.53	4,719.9	870.590	3.943	0.00
32	Metrid lon	0.125000	2	0.57	2,764.7	201.065	0.114	0.00
34	Microcal	0.007813	15	67.94	468.9	1.608	0.109	0.00
47	Pseudo cop	0.007813	13	58.88	439.4	1.489	0.088	0.00
53	Spinocal	0.007813	2	9.06	348.9	0.730	0.007	0.00
63	Oith simi	0.007813	54	244.59	404.4	1.107	0.271	0.00
65	Oncaea	0.007813	11	49.82	353.6	0.745	0.037	0.00
73	Cal.Naup	0.007813	8	36.23	423.7	1.267	0.046	0.00
77	Limnacina	0.007813	49	221.94	531.3	8.278	1.837	0.00
78	oik van	0.007813	3	13.59	449.6	1.523	0.021	0.00
106	Frit. Bor	0.007813	13	58.88	470.0	4.346	0.256	0.00
116	Eukr ham	0.125000	5	1.42	10,017.0	376.408	0.533	0.00
119	Ostracod	0.125000	4	1.13	2,468.5	220.707	0.250	0.00
			278	1,212.46			182.393	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030826** CODE: 030826 REP: 0
STN: **LS2** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (um): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.250000	57	8.07	5,345.1	1558.984	12.578	0.00
8	Calan gla	0.250000	10	1.42	3,597.4	420.444	0.595	0.00
10	Calcop 1/2	0.250000	16	2.26	1,462.2	36.192	0.082	0.00
20	Pareuchaet	0.250000	1	0.14	4,714.5	867.833	0.123	0.00
31	Met 1/2/3	0.007813	1	4.53	449.5	1.386	0.006	0.00
34	Microcal	0.007813	2	9.06	488.1	1.747	0.016	0.00
47	Pseudo cop	0.007813	69	312.53	419.9	1.215	0.380	0.00
53	Spinocal	0.007813	4	18.12	367.0	0.847	0.015	0.00
63	Oith simi	0.007813	90	407.64	387.1	0.999	0.407	0.00
65	Oncaea	0.007813	23	104.18	361.6	0.803	0.084	0.00
73	Cal.Naup	0.007813	18	81.53	344.0	0.698	0.057	0.00
74	Cyc.Naup	0.007813	1	4.53	230.2	0.221	0.001	0.00
77	Limnacina	0.007813	12	54.35	442.3	5.730	0.311	0.00
103	Oiko.sp	0.250000	3	0.42	826.8	7.150	0.003	0.00
106	Frit. Bor	0.007813	35	158.53	447.4	3.847	0.610	0.00
116	Eukr ham	0.250000	3	0.42	7,107.1	264.429	0.112	0.00
119	Ostracod	0.250000	4	0.57	1,114.8	44.817	0.025	0.00
			349	1,168.29			15.406	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030827** CODE: 030827 REP: 0
STN: **L29** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	27	122.29	6,061.2	1884.801	230.498	0.00
8	Calan gla	0.250000	16	2.26	3,290.1	341.475	0.773	0.00
10	Calcop 1/2	0.007813	19	86.06	1,218.9	23.687	2.038	0.00
20	Pareuchaet	0.007813	6	27.18	2,372.2	247.900	6.737	0.00
32	Metrid lon	0.250000	2	0.28	1,617.9	48.932	0.014	0.00
34	Microcal	0.007813	23	104.18	410.5	1.131	0.118	0.00
47	Pseudo cop	0.007813	85	385.00	378.3	0.904	0.348	0.00
53	Spinocal	0.007813	9	40.76	361.9	0.858	0.035	0.00
63	Oith simi	0.007813	51	231.00	368.2	0.942	0.218	0.00
65	Oncaea	0.007813	22	99.65	380.0	0.905	0.090	0.00
73	Cal.Naup	0.007813	21	95.12	317.7	0.610	0.058	0.00
77	Limnacina	0.007813	147	665.82	460.5	12.554	8.359	0.00
78	oik van	0.007813	5	22.65	678.9	4.564	0.103	0.00
106	Frit. Bor	0.007813	18	81.53	391.9	2.921	0.238	0.00
116	Eukr ham	0.250000	9	1.27	12,788.7	665.854	0.848	0.00
157	MedusaeC	0.250000	1	0.14	13,793.6	5187.289	0.734	0.00
			461	1,965.18			251.210	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030828** CODE: 030828 REP: 0
STN: **L31** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	22	99.65	5,801.7	1782.514	177.621	0.00
8	Calan gla	0.007813	9	40.76	3,397.2	368.774	15.033	0.00
10	Calcop 1/2	0.007813	6	27.18	837.3	7.674	0.209	0.00
20	Pareuchaet	0.125000	6	1.70	3,304.0	405.114	0.688	0.00
34	Microcal	0.007813	17	77.00	415.0	1.219	0.094	0.00
47	Pseudo cop	0.007813	36	163.06	370.8	0.848	0.138	0.00
51	Scol minor	0.125000	1	0.28	1,070.6	14.940	0.004	0.00
53	Spinocal	0.007813	8	36.23	341.8	0.697	0.025	0.00
63	Oith simi	0.007813	47	212.88	417.3	1.253	0.267	0.00
65	Oncaea	0.007813	4	18.12	331.6	0.634	0.011	0.00
73	Cal.Naup	0.007813	12	54.35	276.4	0.401	0.022	0.00
77	Limnacina	0.007813	63	285.35	559.6	17.945	5.120	0.00
106	Frit. Bor	0.007813	11	49.82	458.9	4.015	0.200	0.00
116	Eukr ham	0.007813	5	22.65	11,052.2	573.122	12.979	0.00
119	Ostracod	0.125000	1	0.28	809.4	20.072	0.006	0.00
			248	1,089.31			212.418	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030829** CODE: 030829 REP: 0
STN: **L32** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.250000	23	3.26	5,864.0	1752.650	5.706	0.00
8	Calan gla	0.250000	13	1.84	3,108.5	302.059	0.556	0.00
10	Calcop 1/2	0.007813	4	18.12	888.1	9.700	0.176	0.00
20	Pareuchaet	0.250000	5	0.71	2,793.7	284.521	0.201	0.00
32	Metrid lon	0.250000	8	1.13	2,599.1	179.445	0.203	0.00
34	Microcal	0.007813	40	181.17	402.1	1.099	0.199	0.00
47	Pseudo cop	0.007813	40	181.17	361.9	0.810	0.147	0.00
51	Scol minor	0.007813	1	4.53	750.2	5.639	0.026	0.00
53	Spinocal	0.007813	3	13.59	337.3	0.634	0.009	0.00
63	Oith simi	0.007813	33	149.47	370.8	0.938	0.140	0.00
65	Oncaea	0.007813	4	18.12	363.9	0.793	0.014	0.00
73	Cal.Naup	0.007813	15	67.94	334.0	0.714	0.048	0.00
77	Limnacina	0.007813	105	475.58	337.9	4.247	2.020	0.00
78	oik van	0.007813	1	4.53	206.8	0.187	0.001	0.00
106	Frit. Bor	0.007813	9	40.76	447.1	3.815	0.156	0.00
116	Eukr ham	0.250000	7	0.99	11,576.6	573.593	0.568	0.00
119	Ostracod	0.250000	3	0.42	1,358.5	67.667	0.029	0.00
153	Physonec	0.007813	1	4.53	360.1	3.630	0.016	0.00
			315	1,167.87			10.214	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030830** CODE: 030830 REP: 0
STN: **L35** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.250000	26	3.68	4,449.9	1205.528	4.436	0.00
8	Calan gla	0.250000	10	1.42	3,702.0	453.291	0.642	0.00
10	Calcop 1/2	0.250000	10	1.42	1,237.1	23.082	0.033	0.00
20	Pareuchaet	0.250000	4	0.57	3,520.4	476.165	0.270	0.00
32	Metrid lon	0.250000	2	0.28	2,294.7	129.742	0.037	0.00
34	Microcal	0.007813	34	154.00	403.9	1.137	0.175	0.00
47	Pseudo cop	0.007813	20	90.59	418.6	1.220	0.111	0.00
49	Scaphocal	0.250000	1	0.14	3,648.6	430.001	0.061	0.00
51	Scol minor	0.250000	1	0.14	1,237.4	22.219	0.003	0.00
63	Oith simi	0.007813	95	430.29	388.1	1.004	0.432	0.00
65	Oncaea	0.007813	9	40.76	350.5	0.722	0.029	0.00
73	Cal.Naup	0.007813	7	31.71	248.0	0.330	0.010	0.00
77	Limnacina	0.250000	125	17.69	560.2	16.608	0.294	0.00
78	oik van	0.250000	4	0.57	832.2	8.076	0.005	0.00
106	Frit. Bor	0.007813	10	45.29	464.5	4.384	0.199	0.00
116	Eukr ham	0.250000	10	1.42	12,426.3	645.498	0.914	0.00
119	Ostracod	0.250000	8	1.13	868.9	24.116	0.027	0.00
157	MedusaeC	0.250000	5	0.71	8,598.2	2163.207	1.531	0.00
			381	821.80			9.208	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030902** CODE: 030902 REP: 0
STN: **L37** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	28	126.82	6,250.2	1981.726	251.327	0.00
8	Calan gla	0.250000	10	1.42	3,238.6	330.495	0.468	0.00
20	Pareuchaet	0.250000	2	0.28	3,369.6	441.848	0.125	0.00
34	Microcal	0.007813	32	144.94	406.7	1.103	0.160	0.00
47	Pseudo cop	0.007813	44	199.29	344.1	0.685	0.137	0.00
53	Spinocal	0.007813	1	4.53	275.8	0.364	0.002	0.00
63	Oith simi	0.007813	59	267.23	364.2	0.906	0.242	0.00
65	Oncaea	0.007813	6	27.18	326.7	0.608	0.017	0.00
73	Cal.Naup	0.007813	9	40.76	200.6	0.204	0.008	0.00
77	Limnacina	0.007813	190	860.58	372.4	9.964	8.575	0.00
78	oik van	0.007813	3	13.59	649.2	4.426	0.060	0.00
106	Frit. Bor	0.007813	4	18.12	232.3	0.679	0.012	0.00
116	Eukr ham	0.250000	5	0.71	8,479.4	297.621	0.211	0.00
119	Ostracod	0.250000	1	0.14	1,573.6	83.814	0.012	0.00
			394	1,705.59			261.355	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030816** CODE: 030816 REP: 0
STN: **LS1** COUNT DATE: VOLUME (L): 141,300.02
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 500.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	28	1.59	3,374.8	419.415	0.665	0.00
8	Calan gla	0.125000	27	1.53	2,880.7	263.690	0.403	0.00
10	Calcop 1/2	0.125000	43	2.43	989.0	13.851	0.034	0.00
20	Pareuchaet	0.125000	1	0.06	4,581.0	802.180	0.045	0.00
32	Metrid lon	0.125000	20	1.13	1,969.9	83.123	0.094	0.00
44	Pseudo min	0.003906	3	5.44	903.4	9.393	0.051	0.00
47	Pseudo cop	0.003906	19	34.42	479.3	1.845	0.064	0.00
63	Oith simi	0.003906	50	90.59	325.2	0.696	0.063	0.00
65	Oncaea	0.003906	8	14.49	352.8	0.797	0.012	0.00
69	Microsete	0.125000	4	0.23	912.4	9.939	0.002	0.00
73	Cal.Naup	0.003906	23	41.67	263.6	0.370	0.015	0.00
77	Limnacina	0.003906	4	7.25	498.8	7.736	0.056	0.00
103	Oiko.sp	0.125000	12	0.68	733.4	8.456	0.006	0.00
106	Frit. Bor	0.003906	2	3.62	428.8	3.967	0.014	0.00
114	Amph (P)	0.125000	2	0.11	5,953.8	1281.309	0.145	0.00
115	Sagit el	0.125000	3	0.17	20,507.2	1743.536	0.296	0.00
116	Eukr ham	0.125000	3	0.17	9,112.3	620.623	0.105	0.00
119	Ostracod	0.125000	3	0.17	1,989.7	155.217	0.026	0.00
157	MedusaeC	0.125000	1	0.06	7,928.5	1676.270	0.095	0.00
			256	205.80			2.192	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030827** CODE: 030827 REP: 0
STN: **L28** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.250000	19	2.69	5,312.1	1481.830	3.985	0.00
8	Calan gla	0.250000	8	1.13	2,955.2	259.854	0.294	0.00
10	Calcop 1/2	0.007813	14	63.41	1,060.6	16.425	1.042	0.00
32	Metrid lon	0.250000	5	0.71	2,031.8	91.096	0.064	0.00
34	Microcal	0.007813	13	58.88	408.2	1.094	0.064	0.00
47	Pseudo cop	0.007813	58	262.70	385.7	0.979	0.257	0.00
53	Spinocal	0.007813	2	9.06	317.0	0.535	0.005	0.00
63	Oith simi	0.007813	33	149.47	374.4	0.931	0.139	0.00
65	Oncaea	0.007813	3	13.59	358.3	0.755	0.010	0.00
69	Microsete	0.007813	1	4.53	599.8	3.054	0.014	0.00
73	Cal.Naup	0.007813	3	13.59	447.6	1.625	0.022	0.00
74	Cyc.Naup	0.007813	1	4.53	212.8	0.178	0.001	0.00
77	Limnacina	0.007813	103	466.53	588.3	25.588	11.937	0.00
78	oik van	0.007813	2	9.06	783.9	5.313	0.048	0.00
106	Frit. Bor	0.007813	20	90.59	394.8	2.762	0.250	0.00
116	Eukr ham	0.250000	2	0.28	7,146.9	204.393	0.058	0.00
119	Ostracod	0.250000	1	0.14	2,457.4	218.530	0.031	0.00
			288	1,150.88			18.222	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin   SAMPLE DATE: **030829**   CODE: 030829   REP: C
STN: **L33**   COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm   MESH (µm): 150   MOUTH DIA (m): 0.600
DISTANCE (m): 100.0   EFFICIENCY: 100.00%   Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.007813	30	135.88	5,585.7	1629.431	221.409	0.00
8	Calan gla	0.125000	9	2.55	3,143.9	318.387	0.811	0.00
10	Calcop 1/2	0.125000	6	1.70	1,006.5	16.807	0.029	0.00
20	Pareuchaet	0.125000	2	0.57	5,698.2	1591.015	0.901	0.00
32	Metrid lon	0.125000	1	0.28	2,876.3	224.087	0.063	0.00
34	Microcal	0.007813	25	113.23	424.0	1.256	0.142	0.00
47	Pseudo cop	0.007813	24	108.70	355.4	0.759	0.083	0.00
53	Spinocal	0.007813	3	13.59	338.2	0.640	0.009	0.00
63	Oith simi	0.007813	79	357.82	356.0	0.847	0.303	0.00
65	Oncaea	0.007813	7	31.71	323.7	0.609	0.019	0.00
73	Cal.Naup	0.007813	9	40.76	315.8	0.623	0.025	0.00
77	Limnacina	0.007813	71	321.59	391.6	8.508	2.736	0.00
78	oik van	0.125000	3	0.85	852.2	7.243	0.006	0.00
106	Frit. Bor	0.007813	7	31.71	354.3	2.140	0.068	0.00
116	Eukr ham	0.125000	5	1.42	8,652.8	288.475	0.408	0.00
119	Ostracod	0.125000	1	0.28	2,421.3	211.683	0.060	0.00
157	MedusaeC	0.125000	1	0.28	5,212.5	712.479	0.202	0.00
			283	1,162.92			227.274	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin　SAMPLE DATE: **030816**　CODE: 030816　REP: 0
STN: **S12**　COUNT DATE:　VOLUME (L): 28,260.00
GEAR TYPE: MarMap 236　MESH (µm): 236　MOUTH DIA (m): 0.600
DISTANCE (m): 100.0　EFFICIENCY: 100.00%　Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	17	4.81	5,636.4	1654.374	7.962	0.00
8	Calan gla	0.125000	22	6.23	2,771.8	250.744	1.562	0.00
10	Calcop 1/2	0.125000	20	5.66	1,035.0	15.029	0.085	0.00
20	Pareuchaet	0.125000	4	1.13	3,188.5	575.968	0.652	0.00
32	Metrid lon	0.125000	47	13.31	2,178.4	116.196	1.546	0.00
34	Microcal	0.007813	8	36.23	567.4	2.678	0.097	0.00
44	Pseudo min	0.125000	6	1.70	1,169.5	19.288	0.033	0.00
47	Pseudo cop	0.007813	18	81.53	553.0	2.711	0.221	0.00
53	Spinocal	0.007813	1	4.53	594.2	2.978	0.013	0.00
63	Oith simi	0.007813	15	67.94	446.7	1.395	0.095	0.00
65	Oncaea	0.007813	1	4.53	398.6	0.997	0.005	0.00
73	Cal.Naup	0.007813	3	13.59	444.1	1.804	0.025	0.00
78	oik van	0.125000	7	1.98	1,188.8	18.140	0.036	0.00
106	Frit. Bor	0.007813	4	18.12	406.5	3.174	0.057	0.00
114	Amph (P)	0.125000	3	0.85	5,186.6	734.827	0.624	0.00
115	Sagit el	0.125000	4	1.13	20,345.9	1662.299	1.882	0.00
116	Eukr ham	0.125000	4	1.13	18,398.4	1628.873	1.844	0.00
119	Ostracod	0.125000	27	7.64	1,060.0	43.784	0.335	0.00
157	MedusaeC	1.000000	7	0.25	7,716.8	1898.112	0.470	0.00
			218	272.29			17.544	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030824** CODE: 030824 REP: 0
STN: **S24** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMap 236 MESH (µm): 236 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	92	26.04	3,488.6	519.799	13.538	0.00
8	Calan gla	0.125000	16	4.53	2,632.4	230.531	1.044	0.00
10	Calcop 1/2	0.125000	25	7.08	1,019.7	15.617	0.111	0.00
20	Pareuchaet	0.125000	2	0.57	3,668.8	478.172	0.271	0.00
31	Met 1/2/3	0.125000	1	0.28	1,372.6	29.516	0.008	0.00
32	Metrid lon	0.125000	13	3.68	2,077.8	97.187	0.358	0.00
34	Microcal	0.007813	26	117.76	496.8	1.919	0.226	0.00
47	Pseudo cop	0.007813	3	13.59	442.2	1.348	0.018	0.00
63	Oith simi	0.007813	39	176.65	440.0	1.395	0.246	0.00
65	Oncaea	0.007813	1	4.53	448.3	1.376	0.006	0.00
73	Cal.Naup	0.007813	6	27.18	466.8	1.776	0.048	0.00
77	Limnacina	0.125000	98	27.74	593.6	10.981	0.305	0.00
78	oik van	0.125000	10	2.83	810.3	6.781	0.019	0.00
106	Frit. Bor	0.007813	13	58.88	385.2	2.798	0.165	0.00
115	Sagit el	0.125000	1	0.28	30,999.0	4086.109	1.157	0.00
116	Eukr ham	0.125000	12	3.40	11,668.2	542.042	1.841	0.00
119	Ostracod	0.125000	4	1.13	943.4	29.428	0.033	0.00
141	Zoea	0.125000	1	0.28	3,417.8	746.391	0.211	0.00
			363	476.43			19.605	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **040810** CODE: 040810 REP: 0
STN: **B04** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMap 236 MESH (µm): 236 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.015625	39	88.32	4,781.9	1299.584	114.783	0.00
8	Calan gla	0.015625	11	24.91	2,763.2	249.012	6.203	0.00
10	Calcop 1/2	0.015625	3	6.79	1,113.9	19.322	0.131	0.00
20	Pareuchaet	0.015625	10	22.65	3,980.1	927.061	20.995	0.00
32	Metrid lon	0.125000	7	1.98	2,591.2	177.250	0.351	0.00
34	Microcal	0.015625	15	33.97	488.1	1.824	0.062	0.00
47	Pseudo cop	0.015625	2	4.53	455.5	1.442	0.007	0.00
63	Oith simi	0.015625	63	142.68	438.4	1.326	0.189	0.00
65	Oncaea	0.015625	1	2.26	306.0	0.483	0.001	0.00
73	Cal.Naup	0.015625	3	6.79	498.9	1.882	0.013	0.00
77	Limnacina	0.125000	9	2.55	536.7	8.221	0.021	0.00
78	oik van	0.015625	4	9.06	1,242.3	19.478	0.176	0.00
106	Frit. Bor	0.015625	7	15.85	375.7	2.753	0.044	0.00
114	Amph (P)	0.125000	2	0.57	3,442.8	316.210	0.179	0.00
116	Eukr ham	0.125000	7	1.98	18,016.6	1652.565	3.275	0.00
119	Ostracod	0.125000	4	1.13	2,235.8	214.281	0.243	0.00
157	MedusaeC	1.000000	5	0.18	11,969.0	3973.542	0.703	0.00
			192	366.21			147.376	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030821** CODE: 030821 REP: 0
STN: **LS2** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	35	9.91	4,664.5	1076.255	10.664	0.00
8	Calan gla	0.125000	9	2.55	3,418.3	390.006	0.994	0.00
10	Calcop 1/2	0.125000	21	5.94	1,141.6	20.766	0.123	0.00
32	Metrid lon	0.125000	15	4.25	2,361.9	143.230	0.608	0.00
34	Microcal	0.031250	5	5.66	527.2	2.248	0.013	0.00
47	Pseudo cop	0.031250	24	27.18	409.7	1.153	0.031	0.00
53	Spinocal	0.031250	3	3.40	351.1	0.748	0.003	0.00
63	Oith simi	0.125000	39	11.04	428.7	1.280	0.014	0.00
65	Oncaea	0.031250	7	7.93	364.2	0.883	0.007	0.00
73	Cal.Naup	0.031250	18	20.38	463.0	1.768	0.036	0.00
77	Limnacina	0.031250	15	16.99	345.1	3.522	0.060	0.00
106	Frit. Bor	0.031250	5	5.66	532.4	5.530	0.031	0.00
116	Eukr ham	0.031250	1	1.13	11,948.7	521.212	0.590	0.00
119	Ostracod	0.125000	5	1.42	1,115.7	59.423	0.084	0.00
			202	123.43			13.258	0.00

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin SAMPLE DATE: **030823** CODE: 030823 REP: 0
STN: **CB9** COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm MESH (µm): 150 MOUTH DIA (m): 0.600
DISTANCE (m): 100.0 EFFICIENCY: 100.00% Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.250000	107	15.15	3,834.8	734.949	11.131	0.00
8	Calan gla	0.250000	22	3.11	3,565.9	457.541	1.425	0.00
10	Calcop 1/2	0.250000	80	11.32	996.1	13.695	0.155	0.00
20	Pareuchaet	0.250000	6	0.85	2,719.4	295.707	0.251	0.00
31	Met 1/2/3	0.007813	7	31.71	290.8	0.432	0.014	0.00
32	Metrid lon	0.250000	8	1.13	2,392.4	147.170	0.167	0.00
34	Microcal	0.007813	29	131.35	466.6	1.580	0.208	0.00
47	Pseudo cop	0.007813	28	126.82	442.0	1.710	0.217	0.00
53	Spinocal	0.007813	6	27.18	330.1	0.688	0.019	0.00
63	Oith simi	0.007813	72	326.11	433.5	1.330	0.434	0.00
65	Oncaea	0.007813	25	113.23	369.1	0.839	0.095	0.00
73	Cal.Naup	0.007813	12	54.35	437.3	1.412	0.077	0.00
74	Cyc.Naup	0.007813	5	22.65	242.3	0.257	0.006	0.00
77	Limnacina	0.007813	14	63.41	475.3	6.507	0.413	0.00
78	oik van	0.250000	8	1.13	904.9	8.966	0.010	0.00
106	Frit. Bor	0.007813	14	63.41	487.5	5.199	0.330	0.00
112	PteropodB	1.000000	1	0.04	16,317.0	7297.185	0.258	0.00
116	Eukr ham	0.250000	9	1.27	12,735.0	748.506	0.954	0.00
119	Ostracod	0.250000	7	0.99	1,411.4	102.018	0.101	0.00
157	MedusaeC	1.000000	3	0.11	11,732.6	4027.336	0.428	0.00
			463	995.33			16.690	0.00

302

ZOOPLANKTON BENCH SHEET

LOC: Canada Basin   SAMPLE DATE: **030816**   CODE: 030816   REP: 0
STN: **L12**   COUNT DATE: VOLUME (L): 28,260.00
GEAR TYPE: MarMAP 60cm 150µm   MESH (µm): 150   MOUTH DIA (m): 0.600
DISTANCE (m): 100.0   EFFICIENCY: 100.00%   Enumerator: IR

Zooplankter Code	Name	Fraction Analysed	Number Counted	Density (#/m3)	Length (µm)	Weight (µg)	Biomass (mg/m3)	EggDensity (#/m3)
7	Calan hyp	0.125000	4	1.13	3,022.5	569.375	0.645	0.00
8	Calan gla	0.125000	10	2.83	2,775.2	232.506	0.658	0.00
10	Calcop 1/2	0.125000	15	4.25	987.2	16.419	0.070	0.00
20	Pareuchaet	0.125000	3	0.85	4,596.4	1347.800	1.145	0.00
32	Metrid lon	0.125000	28	7.93	2,238.4	126.423	1.002	0.00
34	Microcal	0.007813	7	31.71	435.6	1.317	0.042	0.00
47	Pseudo cop	0.007813	24	108.70	545.0	2.712	0.295	0.00
53	Spinocal	0.007813	14	63.41	502.2	1.983	0.126	0.00
63	Oith simi	0.007813	51	231.00	356.1	0.823	0.190	0.00
65	Oncaea	0.007813	14	63.41	325.3	0.608	0.039	0.00
73	Cal.Naup	0.007813	45	203.82	320.2	0.606	0.123	0.00
103	Oiko.sp	0.125000	4	1.13	2,052.1	70.583	0.080	0.00
106	Frit. Bor	0.007813	2	9.06	560.0	5.903	0.053	0.00
115	Sagit el	0.125000	1	0.28	15,974.5	975.892	0.276	0.00
116	Eukr ham	0.125000	5	1.42	11,435.4	748.171	1.059	0.00
119	Ostracod	0.007813	2	9.06	981.6	30.603	0.277	0.00
132	Thys.spin.	0.007813	1	4.53	13,133.3	2220.779	10.059	0.00
138	Barn.Naup	0.007813	1	4.53	557.5	2.500	0.011	0.00
157	MedusaeC	1.000000	13	0.46	7,029.5	1404.258	0.646	0.00
166	Poly larv	0.007813	1	4.53	1,420.8	0.000	0.000	0.00
			245	754.03			16.796	0.00